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Vol. 5

VOLVME V JAN. 1896 No. 1

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

Cushing Building, 85 Water Street, Boston.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

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Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

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The Brickbuilder is published the 20th of each month.

THE IMPORTANCE OF QUALITY IN ARCHITECTURAL CLAY PRODUCTS.

THERE is a time-honored and somewhat time-worn commercial maxim which says that competition is the life of trade. This was very true in the early days, when business methods were limited by so many practical considerations, and the market far exceeded the supply, but in the latter days of this busy century, where the struggle is so keen and the rewards so precarious, competition may be the life of trade, but it is the life which destroys by wearing itself out in fruitless attempts to rise. Indeed, in many lines to-day competition is almost synonymous with evil results. By this we do not mean that competition of itself is an evil, but the kind of competition which seems to almost inevitably arise in nearly all of the manufacturing lines tends in most cases to diminish the quality of the product and the possible profits of manufacture in almost exact proportion to the extent to which competition is carried. Given the inherent qualities of human nature, together with the possibilities which machinery has placed within the hands of eager competitors, and competition in nine cases out of ten will result in a cheapened product or bankruptcy. We have only to look around on the numerous business wrecks to see how true this is. The burnt clay industries have been until quite recently in a measure free from the ruinous competition which has affected nearly every line of manufacture, but we are now threatened with an accumulation of the same troubles which in the past wrought so much havoc in manufactured products. This is apropos of the circular recently issued by the chairman of the executive committee of the National Association of Fire-Brick Manufacturers, calling attention to the steady decline since 1893 in the prices which could be obtained for burnt clay products, and urging the desirability of cooperation or combination in some form which should stop the continued cutting of prices.

At first thought this suggests monopoly, and the political economist will hold up his hands and say the remedy is worse than the disease. And yet we question whether a little careful thought will not convince any one that under existing conditions the only hope either for profits or for good work is in some form of combination, which, either by restricting the product within legitimate limits or by increasing the capabilities of the manufactured article, will leave a larger margin to be devoted to the betterment of the intrinsic value of the manufactured articles.

IN these times of low prices, when competition waxes hot among manufacturers and buyers have it pretty much their own way, it is of special importance that the quality of architectural clay productions be most carefully considered. It is sometimes said that every man is in business for the money that can be made, whether it be manufacturing or buying and selling. This is not strictly so, or, at least, there are other aims and ambitions which animate men's minds. For instance, two men commence business. Each writes upon his banner the motto, "First quality goods, always reliable."

One looks upon his motto as a pledge to his customers to be sacredly kept by him through all the vicissitudes of business. Sharp competition comes upon him; he knows that his competitors are under-selling him, and he knows also that they do it by lowering the quality, and, therefore, the cost of their production. To meet them he lowers his price to barely cover the cost, looking to the future improvement of business for his reward, but he keeps the quality of his goods to the standard which he has set, and if he is driven to cut to the level of cheaper goods he gives the buyer the benefit of the quality, and stands the loss himself. In other words, he values the reputation of his goods higher than he does a few more dollars made in the business.

The other looks upon his motto as a device for catching trade; he talks very enthusiastically about the quality of his goods, and when he cuts the price in order to secure the largest orders he has much to say about improved methods, known only to himself, which enables him to under-sell his competitors; but all the time his aim is to cheapen the cost, not only (as is proper) by improved methods, but also at the sacrifice of thoroughness in the manipulation of his clay, or by the introduction into his mixtures of material which is especially cheap, but tends to lower the quality of the goods, or if he is a buyer and seller, he makes it his object to buy the very cheapest goods he can find in order that he may under-sell his competitors; anything will do if it is only cheap.

These two, perhaps, are extreme cases, but they illustrate two distinct policies which actuate manufacturers and material men, as well, perhaps, as those in every other line of business.

A manufacturer of sewer pipe was asked not long ago why he did not sell his goods as low as some of his competitors. "I will tell you why," said he; "they grind their clay fifteen minutes; I grind mine twenty-five." That additional ten minutes cost him something in steam power, wear and tear, and in labor, but, as he said, it appeared in the superior quality of the goods. The great aim of many clay machinery men in these times appears to be to offer to the manufacturer some new device which shall enable him to cheapen his product, and too often the question of the quality of that product has been overlooked in the anxiety to save something in the cost, that a low selling price may be made.

There is no class of manufacture where the quality should be considered more carefully than in architectural clay products. The material itself, when properly manufactured, is indestructible. It is made for all time, and a few dollars saved at the outset, at the expense of quality, is really a much larger sum thrown away.

The irresponsible "agent," whose chief object is his commission, and who is so ready to promise and even "guarantee" anything which the buyer demands, is sure to involve not only his principal but his customer, also, in serious trouble. The manufacturer whose price is considerably below those who have been long in the business and thoroughly understand it should be looked up pretty carefully before trusted with important work. It may be found that his work is cheap because he employs cheap labor or does not apply to his manufacture that thoroughness of execution which is employed by his higher-priced competitor.

This is by no means an argument in favor of giving work to the highest bidder, but simply to emphasize the fact that the goods that are the cheapest in price are not necessarily the goods which it is wise to buy. Take the question of discoloration of buff bricks. There have been demands by architects and owners to the effect that buff bricks must be guaranteed not to turn green, and there have been plenty of enterprising "agents," and perhaps some manufacturers, who have been so anxious to make sales that they were only too willing to guarantee their brick not to turn green. The order has been secured. The bricks have been shipped and put into the building, and, lo, in due time the neighbors' goats gather round and trample each other in their efforts to browse off the walls. What can be done? A great deal of growling, some swearing, threats of lawsuits with heavy damage claims, etc.; but usually the matter is adjusted without much, if any, claim upon the man who sold the brick. The goats and the weather after awhile clear the building of most of the vegetable matter, leaving it somewhat dirty looking, to be sure, but much better than the owners feared at one time, and the enterprising "agent" goes off and "does it again."

WE have sufficient confidence in the ultimate possibilities of the burnt clay industries to consider them as the most suitable materials for building purposes which the market now affords. We believe that the present extended use of brick and terra-cotta is not the mere passing fashion, but is the beginning of a steady growth which shall be much more extensive in the future than it has been in the past, and which will give employment to a great many manufacturing concerns. But if, however, a system of competition is allowed to exist between the manufacturers by which the prices are forced down below what will give a fair return on the capital invested, the fact that a few concerns will still continue to turn out good work will not prevent a great many more from meeting the cut in prices by a corresponding cut in quality. The prospect of a vastly increased market with a vastly diminished financial return is one that ought not to be tolerated. We would be the last to encourage a monopoly which would stifle legitimate business or would wring vast profits from the helpless consumers. But we do not believe the conditions could ever be such as to render this possible, while, on the other hand, if the manufacturers could unite on common ground, could agree upon some combined action, we believe that the terra-cotta and brick industries would be vastly benefited in the first place, and as an immediate consequence the consumer would get a better material for his money. The amount of money which is annually sunk in useless competition, if applied to bettering the product, would lend a life to the trade such as could not be obtained from any system of cut-throat prices. We believe in cooperation, because, in our judgment, it implies a better product. We do not believe in mere competition, because it is sure to result in cutting the prices and in cheapening the goods. And it is to be hoped that Mr. Homes' excellent circular may be taken to heart by every member of the Association of Fire-Brick Manufacturers, and may result in placing these industries upon a better and more legitimate basis.

JOHN STEWARDSON.

THE death of Mr. John Stewardson, of Philadelphia, is a distinct loss to the architectural profession. He bore so prominent a part in the architectural development of the last few years, and his name has been so thoroughly identified with the best aims of his profession, that, though his place may be filled, his influence will not be forgotten. He was enthusiastic, artistic to the highest degree, a man who viewed architecture not merely as a means of gaining a livelihood, but as an expression of his real, innermost feelings, and one of whom we cannot have too many. It is with the keenest personal sense of bereavement that we are obliged to chronicle his death.

At a meeting of the Philadelphia Chapter of the American Institute of Architects the following minute was adopted: —

"It is with deepest sorrow we have learned of the sudden and untimely death of our friend, John Stewardson.

"In commemoration of his influence among us, we would here inscribe a tribute to his kindly and noble character and his high artistic nature.

"His professional career, though terminated before there was opportunity for the full realization of the promise he gave, did much to raise the standard of architecture in Philadelphia, and his executed work has placed him among the first of American architects.

"While his natural gifts and his attainments made us respect him as an artist, it was his sunny, buoyant nature that drew him to us as a friend. He was ever ready to help, advise, and instruct. He was devoted to his life work yet his sympathies were not limited by it.

"It is impossible to voice the overwhelming sentiment of loss we feel, a loss not alone to ourselves, but to the community in which his work will stand as an enduring monument to his genius."

PLATE ILLUSTRATIONS.

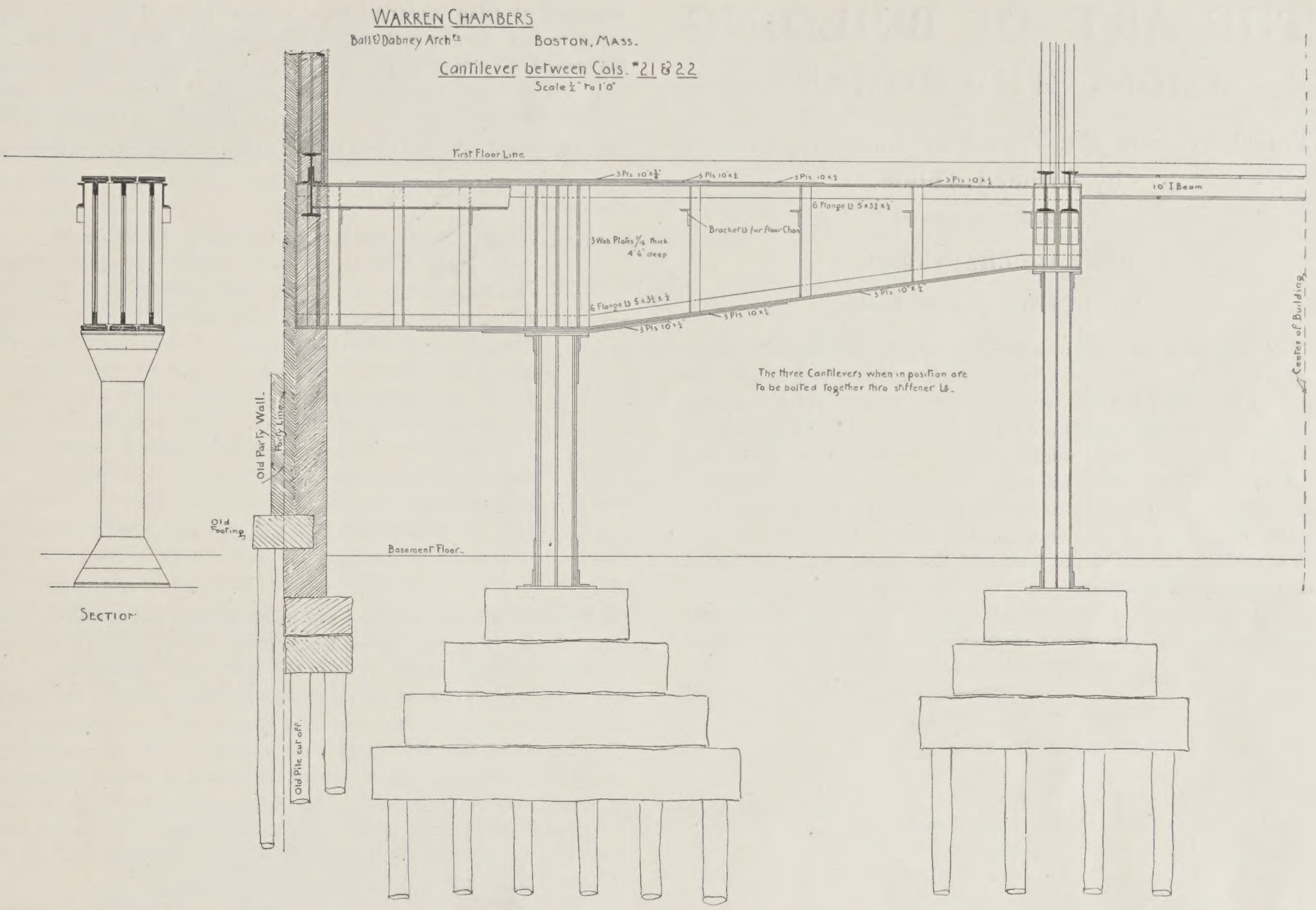
PLATE I. Measured drawing by Mr. C. H. Alden, Jr., of Cloister of San Francesco, Brescia.

PLATE 3, 4, AND 6. The Warren Chambers is designed for an office building, for the exclusive use of physicians and specialists allied with the profession. The typical floor plan is arranged in suites, comprising a reception room, operating-room, and laboratory. A few of the suites are so arranged that two doctors may have the use of a reception room in common. On the second, fifth, and seventh floors are men's and women's lavatories for general use. The first floor is adapted for stores intended to be occupied by trades related to the medical profession.

The building is entered through a vaulted white marble vestibule and a corridor of sienna and verde antique marble. The elevator hall and staircase on the first floor are of sienna marble, and all the metal work is of bronze, as is the staircase above.

The basement in the rear contains storage space for the stores above, and in the front portion are the boilers and elevator machinery. Under the area in front of the building are the engines and the electric plant, lighted from overhead by sidewalk lights.

The building is entirely of skeleton construction. The walls, both external and party, are carried by the frame at each floor, as well as the floors themselves. At the first floor level the loads of the wall along the party line rest on the short arms of a series of cantilevers, which transmit them through columns in the basement to a point varying from seven to eight feet from the party line. The cantilevers are counterbalanced at the long arm by the loads from the interior columns. Sufficient space for the proper spread of footings is thus



obtained to enable all foundations to be built entirely within the property lines. The footings rest on clusters of piles and, these being removed from the existing foundations, the settlement of the adjoining property is reduced to a minimum.

PLATES II AND V. The problem to be solved by the architect when called upon to plan and design a building for this site may be stated as follows: How shall a building be put upon a corner lot containing only about 797 sq. ft. of land with one street frontage of 39 ft. 4½ ins., and the other of only 10 ft., so planned as to use the land to the best advantage, and so designed as not to offend the eye, bearing in mind the fact that the land is assessed at a comparatively high price, and that a fair financial return is desired upon the value of the land and the cost of the building proposed?

Consideration of the size and situation of the site showed that an office building was the only kind of building from which a reasonable financial return could be expected, and that in consequence of the value of the land more than six stories of offices would be required to make the total investment pay reasonably well. It seemed that in order to prove attractive to tenants the building must be fitted with such conveniences and finished in such a manner as to compete with the best class of office buildings in the city, and after much consideration this was finally determined upon. As a building of the height finally planned must be of fire-proof construction it was, to save room, decided to use a steel skeleton. These preliminaries being determined, the economical and convenient arrangement of rooms, halls, entrances, elevator, and toilet rooms demanded the most careful study. The projection of bays added materially to the room space, and the bay at the corner of Milk and Broad Streets served the double purpose of increasing rentable space at the point most needed, and at the same time did much to increase the apparent width of the end of the building on Broad Street, and this, it will be seen, was most desirable in a front of really only 10 ft. with a height of eight stories. To save space still further the interior partitions above the first story are built solid of iron lath and plaster and are only 1¾ ins. thick; and in connection with this it will be noticed that the semicircular iron staircase is enclosed with this same sort of thin partition, and the question was what to do with the face of the wall exposed to the stairs. A dado or sheathing of something other than wood or plaster was desirable, both on account of wearing and fire-proof qualities. Marble mosaic laid with small tesseræ seemed to offer the advantages of being noncombustible, durable, and easily conformable to the curved surfaces of the wall and yet thin enough to economize room. To give apparent size to the building it was determined to keep the exterior as light colored as possible, and Milford Park granite, limestone, and a light yellow brick made especially for the building by the Perth Amboy Terra-Cotta Company have been used with a satisfactory result. Before the building was erected doubts were expressed as to whether desirable offices could be planned for such a small lot, and even if the offices were satisfactory from a tenant's point of view, could the rents satisfy the owner? The result at present seems to be that the offices are desirable and the owner will get something better than five per cent. net on the total value of land and building.

WE are desirous of securing back numbers of THE BRICKBUILDER for the following months: May and July, 1893; March, May, June, September, 1894; February and July, 1895. Parties having these numbers, and who are willing to dispose of them at the regular subscription rate, will confer a favor by addressing the publishers of THE BRICKBUILDER.

THE very material increase in our subscription list during the month of January, in addition to the large number of renewals, is a most gratifying indorsement of our work, and will be met by a renewed effort on our part to merit the generous support that is being given us.

THE ART OF BUILDING AMONG THE ROMANS.

Translated from the French of AUGUSTE CHOISY
by Arthur J. Dillon.

PART II. CHAPTER II.

VAULTS OF CUT STONE.

IN describing the Roman vaults of cut stone, we will again have to take up a series of methods of construction whose origin was foreign to Rome, but this time it is Etruria from which it comes. All types of vaulted construction were to be found in the monuments erected by the Etrurians or under the direct influence of their civilization; the Cloaca Maximus is an example of a barrel-vault with a curved axis; the Mamertine prison is ceiled by a flat vault; the outlet of the Lake of Alba terminated on the plain in a conical vault on spreading piers; and the lintels of the doors of the theater of Ferrento were flat arches.

Many of these Etruscan vaults, to be sure, are but rude and imperfect attempts, where the inexperience of the builders is shown by faults such as those in the ceiling of the Mamertine prison (Fig. 75). But in others the arrangement of the stones shows an elegance that approaches an extreme; stones of different form and size alternate in regular order, and their assemblage seems calculated with a view to reduce as far as possible the number of large voussoirs; the arch of Volterra, whose developed extrados is shown in Fig. 76, is a remarkable example of this care in arranging the stones.

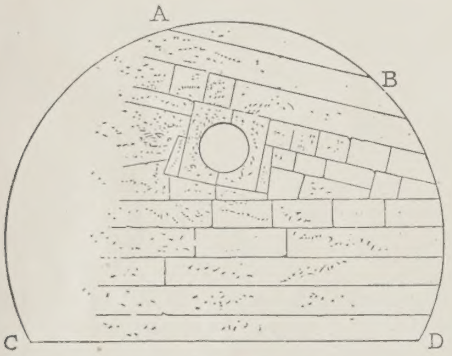


FIG. 75.

It is hardly necessary to recall the place the Etruscans gave to the round arch in their architecture from the earliest times. The ornaments which they attributed to it have been consecrated by tradition; the impost, the carved keystone, the archivolt, all the essential members of the Roman arcades are to be found in the Etruscan door of Faleria. The Romans made only insignificant or regrettable changes in this beautiful and dignified motive; their attention was directed entirely toward the methods of construction, and with cut stone, as with rubble vaults, the result of their efforts was the development of a systematized economy.

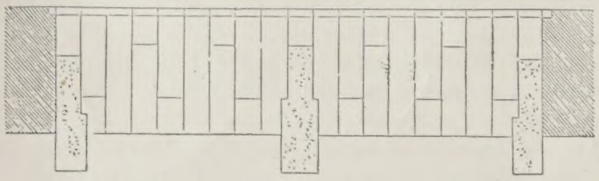


FIG. 76.

A first custom, evidently arising from the spirit of economy, was that of using centering for the upper parts of the vaults only, using to hold up the centering salient voussoirs, such as are seen in the bridge of Gard (Fig. 77), the bridge of St. Barthelemy at Rome, etc. All the part lying below the projecting voussoirs was built without auxiliary support; sometimes, to prevent the voussoirs from slipping during the time when there was yet nothing to hold them in place, care was taken to fasten them with dowels and mortises, as in the Coliseum (Fig. 78). Elsewhere, without being able to discover what method was adopted to delay the time when centers would be necessary, we can at least see that no support was used for the stones near the springings; thus there is a Roman vault near the route of Eleusis, whose intrados, rough and unformed near the springing, becomes smooth and regular toward the crown, a certain indication of where centers were used. The rough voussoirs are those that the builder put in place without centering; it was only when it was necessary to rest the keys on the planks of the centering that it was thought worth while to dress and smooth the intrados.

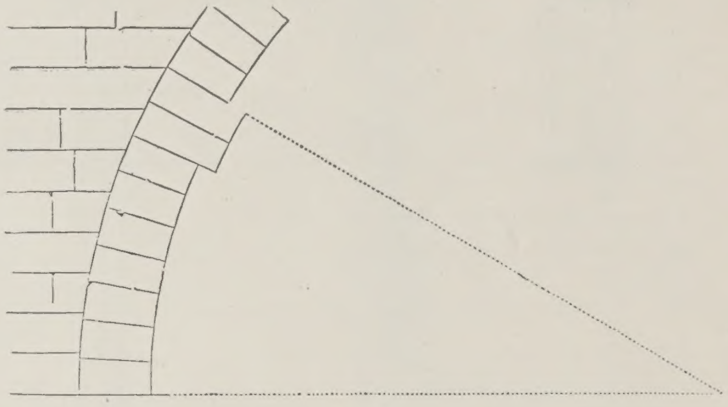


FIG. 77.

The lower part of the centering thus done away with, the Romans sought to simplify the remainder; so much so that, among the different methods of arranging the stone, that on which their choice rested often offered no other advantage over the others than that it involved the use of a cheaper and less complicated centering; thus it was at the bridge of Gard.

The stones here do not, as in modern vaults, dovetail and interlock; each span is formed of a number of narrow arches in no way bonded together (Fig. 79). All the keys in the same arch have their lower sides of exactly the same length, and the vault is, as it were, divided into contiguous but separate and independent sections.

This interruption of continuity is quickly justified when one considers the ideas which brought it about. What, in fact, was necessary to sustain such a vault? A frame at each end and one at each of the lines between two consecutive arches. No planking was needed; each key B spanned the space between two frames and rested directly on them at its extremities (Fig. 80).[1] All the difficulty lies in making the voussoirs equal, but this is of no importance when the stone is found in such great thick beds as those from which the stone for the bridge of Gard was taken, for then the uniformity of size can be obtained without waste, and it even makes the quarrying cheaper by making it simpler. And it was just where such favorable conditions were to be found that the Romans used the unbonded masonry. Its principal examples are found in the region of the bridge of Gard; one can cite not far from there the arches of the great viaduct crossing the valley of the Vidourle at

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[1] This explanation is taken from Viollet le Duc's *Dictionnaire raisonné de l'Architecture Francaise*, Vol. IX., p. 488. Before becoming acquainted with the recent works on the subject where this is described, I supposed that the builders of the bridge of Gard used the same center over and over again, moving it in turn to each of the rings, A, B, C, etc., which compose the vault. But it would be hard to maintain this hypothesis here, for a center of only the width of one of the rings would be too narrow for its span; it would not have base enough, and would probably fail. But, as a general proposition, the idea is well in the spirit of Roman construction, and it is not impossible that it is the true explanation of the construction of similar vaults of smaller span.

Sommieres, the upper vaults in the amphitheater of Arles (Pl. XVII., Fig. 1), those of the arena at Nimes, those of the lateral galleries of the so-called Temple of Diana; and this form of construction was so well suited to the materials of the country that when, in the twelfth century, the bridge of Saint-Benezet of Avignon was built, the architects of the middle ages knew of no better way than that pointed out by these numerous and magnificent examples.

The Romans had then done away with a costly part of the centering, the planking; but they could go still further, and, while still keeping the advantage of the first simplification, considerably diminish the weight on the centering. The expedient which permitted them to do this is well enough shown in Fig. 81; in place of placing the arches A, B, C, etc., so that they touched each other, they placed them some distance apart, covering the interval afterwards with a series of slabs following the curve of the vault.

The economy is evident. The weight on the centering is that of the arches A, B, C; the slabs between are held up by the arches, and the centering gets no part of their weight. In other words, the arches themselves serve as centers, and the advantages of discontinuous masonry are thus combined with those arising from the use of armatures; the planking is suppressed and the pressure on the centering diminished.

This method of construction is found in an ancient monument belonging, like the bridge of Gard, to Roman Gaul, known as the Temple or Baths of Diana at Nimes (Pl. XVI., Fig. 1).[1] The arches which served as centers have on the extrados deeply cut rabbetts into which the ends of the slabs fitted; on the interior these arches are marked by their projection, which is considerable. Their function is thus manifested with the utmost clearness; and the architects, profiting by an arrangement dictated by economy, made from it one of those motives of ornament whose effect is always pleasing, because they arise from the principles of good construction.

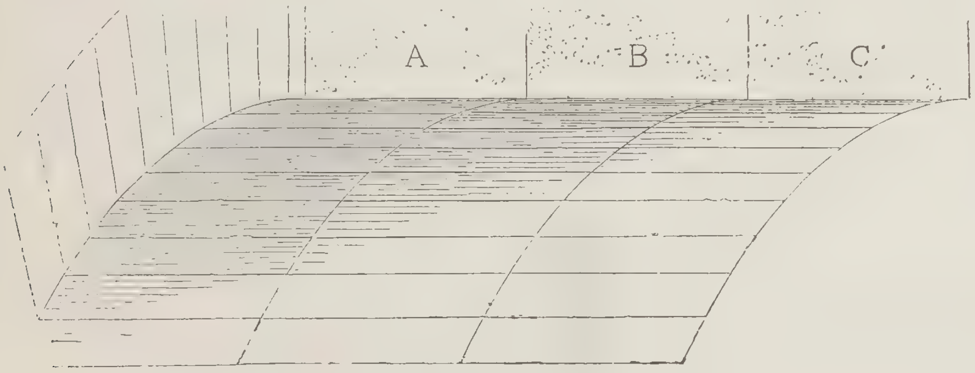

FIG. 79.

This system, which resumes, it might be said, the practical resources of the Roman art, gave rise, in our country and especially in the oriental regions of the Roman Empire, to a variant of considerable importance. I show its character by an example taken from the subterranean vaults of the arena of Arles (corridor on the prolongation of the principal axis of the amphitheater, Pl. XVI., Fig. 3).

Here the slabs between the arches no longer follow the cylindrical surface, but form a sort of platform; each arch carries a little wall, like a tympanum, leveled off even with the crown of the extrados, and the slabs, placed on the horizontal top course of this wall, make a plane surface which can be utilized as the floor of another story; thus there was no necessity of placing a flooring over the vaults for the same slabs served as a ceiling of the lower gallery and as the floor of the rooms above it.

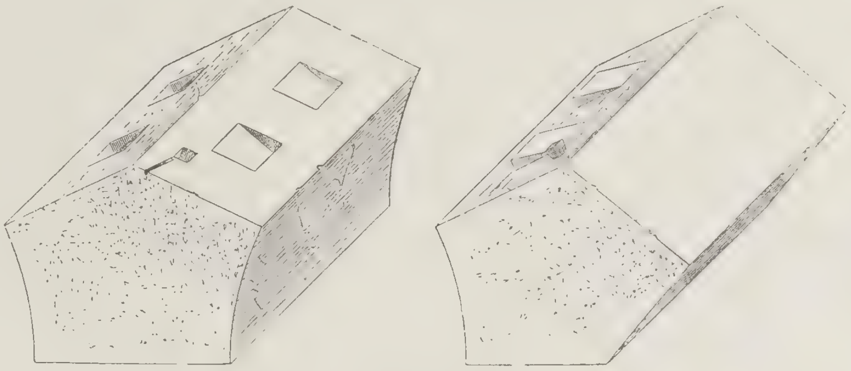

FIG. 78.

This kind of vault had also another merit,—that of avoiding the difficulties which arise when two rectangular galleries intersect; it was only necessary that their intersection should not interfere with the arches,—that is, that it should be between two consecutive arches. This species of intersection is found in the galleries of the arena of Arles, and other examples are to be seen in the drawings accompanying the work of M. de Vogüé on the Syrian monuments of the first centuries of our era. In Syria the isolated arches carrying horizontal slabs by means of tympanums were widely employed; an entire system of construction, and even a whole system of architecture, is founded on their use; basilicas, with large naves and two-storied side aisles, dwellings, and tombs have their roofs and floors formed of these horizontal slabs carried on isolated arches. The Romans thus obtained light vaults which were perfectly solid, while the expenditure of materials was reduced to a minimum. The tympanums prevented the deformation of the arches and played nearly the same role as the backings of rubble in the vaults described in the first part. Moreover, the thrusts were not difficult to meet, for they were brought to isolated points; to counteract them it was not necessary to exaggerate the thickness of the walls; it was sufficient to place buttresses opposite the arches, and partition walls, made necessary by the plan of the building, often were used for this purpose: in other words, the exterior wall was no longer the support of the vaults; it was only a screen, which could, without interfering with the solidity of the edifice, be pierced by many openings, whose form and arrangement

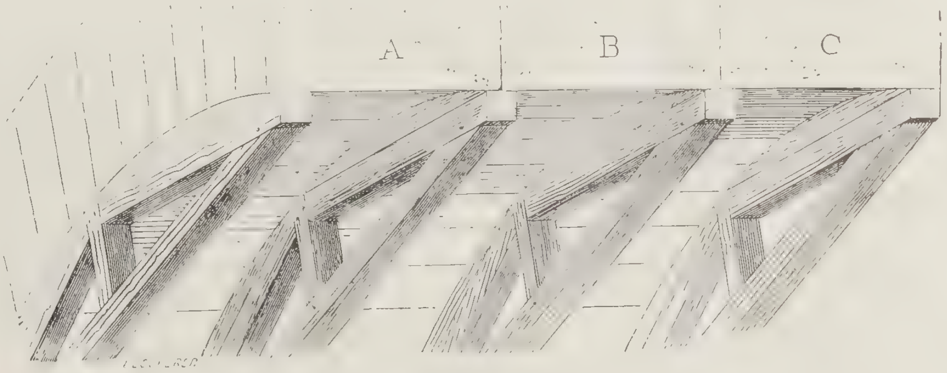

FIG. 80.

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[1] The description of the arrangement of the parts of this vault is one of the pieces of information for which I am indebted to M. Aures, engineer in chief. It is to be understood that the sketch (Fig. 81) is not a restoration of the temporary centering of the vault; I do not know whether there was but one center for each ring or two; what seems probable is that there was no planking; what is certain is that the pressure on the centering, whatever its form, was greatly reduced.

were controlled by no exigency of construction. Hence, there was great liberty in the design of the edifices; and hence that mass of original conceptions in the first centuries of our era, in the architecture which the researches of M. de Vogüé have made known to us.

In order to complete this study of vaults with ribs, I should say a few words about a system with which the architects of the bridge of Narni experimented; it would seem that the experiment was not successful, for they abandoned it after having tried it in a single arch at one of the extremities of the bridge (Pl. XIV., Fig. 2 and 2bis, and Pl. XXI.). Here, as in the baths of Nimes, the general appearance is that of a barrel vault with salient ribs, but it would be fruitless to seek the keyed slabs held up by the arches. The stones of which the vault is built dovetail into each other in such a manner that it is impossible to distinguish either armature or covering; it is a barrel vault, probably built course by course, the arches being reduced to ribs bonded into the rest of the construction, adding to its rigidity; its strength is probably equal to that of a solid vault of the same total thickness, while its weight is less; and this is, I think, the principal advantage of the system.

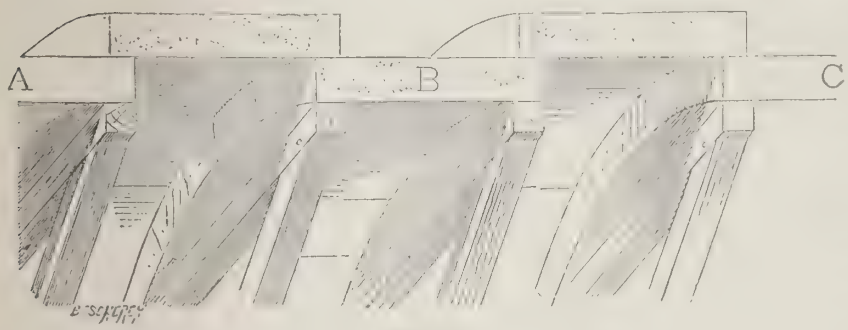


FIG. 81.

I will not try, however, to justify in all its parts a system which the Romans seem to have been the first to condemn. The difficulties of fitting together all the stones which dovetail into each other surpass or balance the economy of material and of centering resulting from the lightening. This without doubt led them to give up the method, and, warned by this failure against such expedients, they went back, for the three remaining arches, to the ordinary method of barrel vaults with alternating joints.

(*To be continued.*)

OUR TIME-HONORED INDUSTRY.

THERE is no building material so durable as well-made bricks. In the British Museum are bricks taken from the buildings in Nineveh and Babylon which show no sign of decay or disintegration, although the ancients did not burn or bake them, but dried them in the sun. The baths of Caracalla and of Titus in Rome, and the Thermae of Diocletian, have endured the ravages of time far better than the stone of the Colosseum or the marble of the Forum.

THE Park Building at Pittsburg, Geo. B. Post, architect, will have some of the richest terra-cotta detail of any building in the country. Plates 76 and 79 contained in our December number show the elaborate manner in which Mr. Post has employed this material. Later we shall publish some half-tones from photographs of the details made at the works of the Perth Amboy Terra-Cotta Company.

AT the annual election held at the Omaha Builders' and Traders' Exchange, Jan. 6, 1896, the following gentlemen were elected officers.

President, J. Walter Phelps; vice-president, W. C. Bullard; treasurer, W. B. Rutherford; secretary, W. S. Wedge, for five years.

Directors: — M. B. Copeland, Chas. Baxter, Thos. Herd, J. H. Haste, G. H. Kelly, A. D. Harriott.

ARCHITECTURAL TERRA-COTTA.

BY THOMAS CUSACK.

THE principal towns of Roman England are said to have been adorned with temples, courts of justice, theaters, statues, baths, and other public buildings,— a colonial imitation, it may be presumed, after the manner of the Imperial City. But to say, as Sir Francis Palgrave does, that "the country was replete with Roman magnificence" is, we think, rather too magnificent a way of stating the fact that the Romans did introduce the art of brickmaking, and that they made very extensive use of bricks in such buildings as they brought into existence. Their influence in every branch of industry was strong and wholesome while it lasted; but, after all, it was an exotic that did not take root sufficient to produce a spontaneous growth. With their exit from the scene of their triumphs in arms and in the industrial arts, the Britons relapsed into their former condition of semi-civilization. The marauding Danes came but to pillage and destroy, and the invading Saxons were no better qualified than the natives to fill the place vacated by the highly trained and masterful Romans. They had been accustomed to houses of roughly hewn wood and rude huts roofed with brambles, and such of the remaining Roman edifices as they did not wilfully demolish, they, by indifference and neglect, allowed to fall into ruin and decay before the time of Bede or the early chroniclers.

A Roman wall still exists in Leicester, an arch in Lincoln, foundations and other traces of their buildings have been dug up in Exeter and Colchester, etc. Watling Street and other highways have been merged into modern coach roads, leading from London to the north and west of England. Interesting remains of pottery, tiles, and tessellated pavement have been found in various parts of the country in the course of building excavations. Bricks taken from the Roman-built town of Verulamium were re-used during the eleventh century in building the adjacent abbey of St. Albans. These are about the only visible traces that now remain of that race of warriors and brickmakers whom Boadicea and Caractacus had vainly sought to expel from

> "That pale, that whitefaced shore
> Whose foot spurns back the ocean's roaring tides
> And coops from other lands her islanders."

The use of stone was traditional with the fortress-building Normans, and likewise in accord with the temperament of a people whose first article of faith was embodied in the old rule and simple plan, that he who hath may hold, and he may take who can. Yet the sturdy piers, and round arches, and the ornament commonly used in their churches were as well suited to the employment of molded forms as the kindred Romanesque of Northern Italy had proved itself to be. The art of ordinary brickmaking, however,

HURSTMONCEAU CASTLE, SUSSEX.

seems to have been as completely forgotten in England as if it never had existed. It disappeared soon after the departure of its founders, and was not revived again until late in the thirteenth century. Even then it was re-introduced by way of Flanders, and that only in the neighborhood of seaport towns along the east and south coast, which, being the channels of European intercourse, were the first to be influenced by the customs and building methods of other countries. Thus in the town of Hull, then, as now, the chief port of entry for shipping from the Baltic, we find in *Leyland's Itinerary* that "Michael de la Pole, merchant of Hull, came into such high favor with King Richard II. that he got many privileges for the towne. And in hys tyme the towne was wonderfully augmented yn building and was enclosyd with ditches the waul begun and in continuance endid and made all of brike as most part of the houses of that time was. In the waul be four princepal gates of brike. M. de la Pole builded a goodlie house of brike against the west end of St. Marye's Churche, lyke a palace with goodly orcharde and garden at large, also three houses besides, every one of which hath a tower of brike." Trinity Church, Hull, is likewise referred to by Street as being one of the few examples of good brickwork in England of a date prior to the fifteenth century.

The terra-cotta used in the manor house of East Barsham and the parsonage Great Snoaring, in Norfolk, belongs to the fifteenth century, but whether it was a native product is doubtful. At Wymondham Church, in the same county, situated in the Norman Arcade, there is a sedilla in buff terra-cotta. It is renaissance in design, and evidently of Italian origin, if not of execution; but the otherwise good effect is marred by unskilful jointing, which, by the way, could have been easily avoided. The constructive faculty of the man who designed, and perhaps modeled it, was not (as often happens in our own day) by any means equal to his other attainments. Good Flemish brickwork was done in the fifteenth century at Little Wenham Hall, and at the gateway to Hadleigh Rectory, both in the county of Suffolk. Hurstmonceau Castle, Sussex, with its seventeen octagonal towers and a machicolated gateway, was built in 1448. Our illustration being from a recent photograph, its present state of preservation appears remarkably good.

From Gwilt we find that "molded brickwork and terra-cotta were introduced for ornamental parts by Trevigi and Holbein towards the end of the fifteenth century. At Layer Marney and other places bricks of two colors and highly glazed were used for variegating the surface, and were formed into lozenges. The chimney shafts seem to have exhausted invention in the twisted and diapered patterns into which they were wrought and decorated with beads, and capitals, and cognizances of the founders. The gateways were prominent features in these edifices, and most expensive ornaments were lavished on them. That at Whitehall, designed by Holbein, was constructed with differently colored glazed bricks, over which were appended four large circular medallions of busts, still preserved at Hatfield Peveril, Herts. The gateway contained several apartments, among which not the least remarkable was the study wherein Holbein chiefly received his sitters. The gateways at Hampton Court and Woolterton were very similar to this." Hampton Court Palace itself, that involuntary gift from Wolsey to his irate master, as a sop to Cerberus — where Edward VI. was born, and Jane Seymour died, and Katharine Parr became the sixth wife of the royal Bluebeard — where Mary spent her honeymoon with Philip of Spain, afterwards the favorite residence of Charles I., and later still the permanent abode of William and Mary — is built of brick. In the tower remain the busts of the Cæsars in terra-cotta, presented to "the butcher's son of Ipswich," by Leo X., with others, in the first court, said to be the work of Lucca della Robbia. Here, also, we have the most varied assortment of brick chimneys to be found anywhere. There are circular and square, spiral and multi-angular, with multitudinous diapers, but, if our memory serves us rightly, no two of them are alike. For such as these the poet has furnished a description which, if less prosy, is quite as explicit as the average specification: —

> "Quaint, fantastic chimneys with their store
> Of twisted, carved, and lozenge-shaped devices."

Two brick houses came into prominence in the year 1558, and have remained there during the three intervening centuries of England's extraordinary territorial growth and industrial development. These are St. James' Palace, London, and Hatfield House, Hertfordshire, the latter the ancestral home of the Cecils, and of the present Marquis of Salisbury. Their architectural importance is lost in the teeming historical associations that cluster around them. In one lay Mary, the daughter of Catherine of Arragon, from whose death chamber the attendants made a hasty exit, and the courtiers as hasty a visit to Bishop Hatfield, under whose hospitable roof the daughter of Anne Boleyn awaited the news of her succession to the throne. During the prosperous reign of "the good Queen Bess" brick came into very general use in the modified Tudor Gothic, to which was given the name Elizabethan, by which it has since been known, and which in her own time was aptly idealized by Spencer in the "Fairie Queene": —

> "High lifted up were many lofty towers,
> And goodly galleries far overlaid,
> Full of fair windows and delightful bowers,
> And on the top a dial told the timely hours."

The Lollards Tower of Lambeth Palace is a venerable pile of ancient brickwork that may be cited as a connecting link between the picturesque past and the utilitarian present. It stands on the Surrey side of the Thames, midway between the handsome pavilions of modern brick comprising St. Thomas' Hospital, a little lower, and the great Lambeth Potteries, a little higher up the Albert Embankment. To both of them it seems to nod encouragingly, as if to convey an archiepiscopal approval from His Grace of Canterbury for the meritorious though widely different work in which each of them is engaged. The palatial headquarters of Sir Henry Doulton is one of the most noticeable architectural features that meet the eye in a view to the southwest from Waterloo or Westminster Bridges. The design is the personification of bold and vigorous outline, and, being executed wholly in brick, terra-cotta, and enameled stoneware, it is in itself a very commanding exhibit. Though representing but a few of the branches of this firm's multifarious clay products, it affords, on closer inspection, an impressive object lesson in constructional and decorative ceramics. The range of manufactures in clay carried on here embraces every conceivable style of sanitary goods, from pressed brick and vitrified drain pipes of enormous size to architectural terra-cotta, faience, and majolica ware; and from the common stoneware ink jars to the finest parian statuary, porcelain, and china bric-a-brac, such as were seen at the World's Fair and have not yet been forgotten. The well-earned and well-bestowed title conferred on the head of the firm, in the year of Victoria's jubilee, was a fitting recognition of his success in the revival and reunion of art and industry, conducted on business principles and sustained by commercial enterprise.

THE ALBERT HALL, KENSINGTON, LONDON.

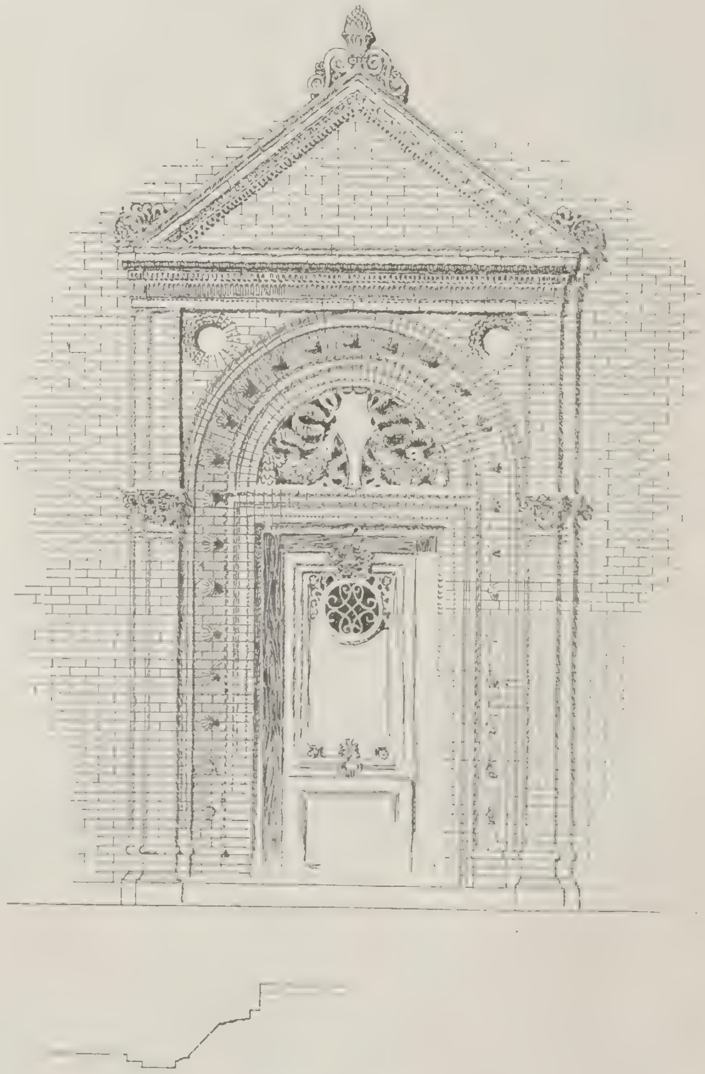
"The Release of Barabbas" is but one of a long series of Biblical subjects which have been depicted with dramatic force on imperishable terra-cotta during the past twenty years for which this firm is responsible, and by which the name of George Tinworth has become famous among sculptors. The genius, the devotion, and the deep religious sentiment embodied in their execution are inherent in the artist; but the resources and the opportunities necessary for their successful production were supplied by Doulton & Co. Without sympathetic encouragement and cöoperation in his earlier efforts, the embryo artist might have languished in obscurity, as others have done. The world had then been so much the poorer in works of art and in forceful expositions of the scriptures, which in the estimation of competent critics take rank with those of Donatello Ghiberti and the della Robbias.

NOTES ON DESIGN OF BRICK BUILDINGS.

BY GEORGE F. NEWTON.

NEVER before in the history of building has there been at the disposal of the architect so great a variety of building material, especially in clay products, as at the present day. This fact is evidently appreciated, judging from our parti-colored streets. There is evidence of an earnest desire to make the most of these possibilities of material. We must believe that each effort is a serious one, and misjudged effects arise possibly from lack of observation of precedent or from a desire to be too ambitious and experimental on the part of the designer. It is said that much is learned from mistakes, but it is vastly more improving to do a really good thing, and architecture is too serious an art to experiment upon without some well-grounded principles, acquired through the study of precedent, in order to acquire a cultivated taste. An architect who has studied conscientiously the examples of successful buildings in which the world is rich ought not to do anything very bad, and such research will amply repay all the time devoted to it. It seems inconceivable that any man can cause to be erected a mass of material to be viewed daily, for scores of years, by his fellow-men, and not feel the responsibility that the opportunity puts upon him. The educating power of the architect is truly great, but the blind cannot lead the blind, and there is nothing like the study of precedent to open one's eyes. One cause of this apparent carelessness may be the lack of appreciation of what architecture really means, and of the fact that architecture is a matter of evolution to a great extent.

The true artist must feel a love for his art and possess the stay-



A BRICK DOORWAY.
Published by permission of the Philadelphia & Boston Face Brick Company.

A CASTLE IN THE NORTH OF ITALY.

ing quality which holds him to the design for a building through all its distracting details, done at various intervals. The ability to take up the theme after the interference of perhaps equally important work is indispensable to a successful result. He must feel the love for detail as well as the inspiration induced by the whole scheme.

This spirit is indispensable to the development of a creditable design.

A country may be never so rich in material, but without the artist's hand and heart it might better have remained in its natural state, where it cannot offend. This great variety of materials too often proves a stumbling-block. Some of our modern buildings look as if the designer used them for the display of various materials. During periods when architecture was at its best one kind of material was generally considered good enough for a building; at most, two. The saying that " There is nothing new under the sun " may, perhaps, in a general way apply to this subject. There are, however, many new methods under the sun in the way of applying and combining things which have long existed, in giving the old things a varied appearance. In truth, we can say that many things seem entirely new through this modern evolution.

It might possibly be better for our architecture if we had fewer variations in this list of building materials, as we might then learn to use properly a few good kinds, but experimenting is interesting and equally profitable, if we are discriminating and qualified to extract the goodness from each experiment, avoiding mistakes and treasuring the happy results.

In the course of these articles we will notice how bricks and terra-cotta have been employed in some of the buildings of the past and present. A review of this kind should be profitable. The discussion of any subject generally brings out ideas or throws new light on old ones. Every building must present a positive exterior. What this exterior should be depends upon the problem and the extent to which it lends itself to agreeable architectural treatment, which should be organic, as the logical solution of architectural problems almost invariably produces the best results. In modern buildings we cannot always be too logical from the point of view of past standards. Present methods of construction will not stand this criticism. Le Duc would say that many of our structures had no " style "; yet these constructive methods must be recognized, as their use is expedient. If it is the duty of the architect to utilize modern methods and materials to accomplish certain results in the most consistent and beautiful manner, he must make it good logic and turn present methods to account, and if he fail in the result there is more censure due him than he is willing to acknowledge. The nature and uses of the building and its location generally suggest the kind of material to be used. We are speaking of the customary modern architectural practise. A condition which the architect must accept, viz.: clothing his building in many cases with not only a better quality or different colored material, but one entirely different from that used in its structural portions. We are so familiar with these conditions that we have almost ceased to question their sincerity.

The artist will decide upon his material in part by the position his structure will occupy. He will study the site, with its existing surroundings, and, if he is happy in his choice, will select a material which both in color and texture seems best suited to the environment. A building should harmonize with its neighbors, either by quiet continuation of the prevailing tones or by a telling contrast. If the building is one of public character, it demands an individual treatment, using the possible somber surroundings as a setting for its more brilliant façade. A residence or structure of a private nature seems in better taste when it takes its place unostentatiously and does not seem to demand attention.

These effects are greatly influenced by the color of the material selected. Many otherwise well-designed buildings do not take their places agreeably, owing to an unfortunate selection of the color of its surfaces.

For certain conditions there is no building material equal to stone, if appropriately used. The architect may create a parthenon, a Mount St. Michele, or a village of quaintest type, and each will remain a monument for all time.

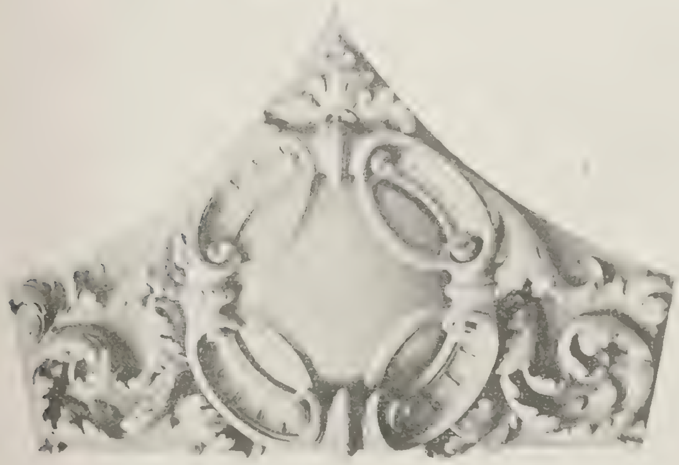
However, many reasons arise which prohibit the use of stone. In fact, in the majority of cases stone is put aside as inexpedient, and the products of clay are substituted. The expense or the difficulty in selecting a stone which can stand in our severe climate or some other objection throws it over.

Few stones seem to be well adapted to our business streets. All soil badly and soon present a dingy appearance. Granite, no matter how highly enriched, seems to turn a cold shoulder to the passer-by. Certain marbles are more inviting and weather well, and should be more commonly used. Georgia, and Tennessee, and the red Vermonts are durable and handsome in color, and if architects would study their use, combined with bricks and terra-cotta, the glories of brick and marble architecture of past centuries might be reviewed in our streets.

The great mass of buildings in our cities are built of bricks. The architect feels that it is a safe material, and he can obtain almost any desired color effect, and he is pretty sure that brick will stay through fire and water and improve in weathering.

He can give his wall any desired texture, from the clean, highly finished surface of sharply made pressed bricks to the robust treatment afforded by the various common brick.

Every architect knows that surprisingly good effects can be obtained with very simple means, and, furthermore, the most satisfactory and pleasing effects are more often accomplished by simple means than by elaboration of material. Some of our modern buildings have been treated very effectively by the simple use of brickwork, by varying slightly the tone of the brick or mortar color in telling places. The manufacture of molded and ornamented bricks has been developing and has extended immensely the architect's field of possibilities. It is proposed to review in these notes as many examples as practicable of the past and present brickwork, and, if possible, discover wherein lie the merits or defects of these buildings, and, perhaps, suggest how agreeable effects may be obtained by using the various materials at our hand.



ILLLUSTRATED ADVERTISEMENTS.

THE adjoining illustrations are from a thirteen-story building just completed, on Broadway, Broome, and Mercer Sts., New York City, a perspective drawing of which was reproduced in our issue for September, 1895. Mr. John T. Williams is the owner, architect, and builder, and in each capacity we have to congratulate him on this, his latest, and, perhaps, most successful enterprise.

The terra-cotta was furnished by The New York Architectural Terra-Cotta Co., in connection with whose advertisement on page xxiii will be found a portion of the Broome Street facade.

In a future issue we hope to give a view of the whole building, which is certainly one of the most effective examples of terra-cotta construction which has yet appeared on Broadway. It is one which will do much to encourage and stimulate the adoption of that material in the future re-building of this famous thoroughfare.

On page xvii, in the advertisement of Charles T. Harris, Lessee of the Celadon Terra-Cotta Co., is illustrated the palatial residence of Anson Phelps Stokes, Esq., at Lenox, Mass. H. Neil Wilson, Pittsfield, Mass., architect.

On the same page, in the advertisement of R. Guastavino, is illustrated the dome of Grace Universalist Church, Lowell, Mass., Wm. Chester Chase, architect. The dome, which is 70 ft. in diameter, is built upon the Guastavino Arch System.

SHRINKAGE OF TERRA-COTTA.

THIS subject, together with unpunctuality of delivery of blocks, are causes of perennial complaint with architects, but in the vast majority of cases both are due to architects themselves. This is a point which they will not admit, however,— at least as a general body. The working drawings are always late, and the blocks are always wanted before it is possible for the manufacturer to turn them out. This state of things cannot be remedied unless the manufacturer keeps a stock on hand from which the architect must be compelled to select. The latter will not have this at any price, except in regard to a few odd things; and when the building is to be made entirely of terra-cotta it is, naturally, impossible for the manufacturer to anticipate the design. One would have thought that such things were self-evident to the architect, but judging from recent utterances, that is not the case. To some extent shrinkage is no doubt due to the employment of bad earths, but the work is hurried too much to amend things. The architect must allow more time.

On the architect's part it may be urged that the client is always a long time deciding the actual lines on which the building is to be erected, and wastes no end of time in suggesting impossible amendments to the plans. Then, as soon as these knotty points are smoothed over, the client wants the building to be erected with lightning-like rapidity, and everything is all hurry and bustle. This, however, is not all. In approving the block plan and elevation, there are yet many minor points of design about which the client must be consulted, or he feels hurt. After sending sketches of details of terra-cotta ornament, the architect is frequently compelled to wait some time before they are returned — and the client unthinkingly imagines that the work is being proceeded with. An old unwritten proverb is "Would that we (architects) could do without clients."—*The Brickbuilder, London.*

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

ELECTRIC WIRING OF BUILDINGS.

BY F. E. CABOT.

IN these days, when every mercantile building must be provided with electrical currents for light, power, and the transmission of messages, and when the use of iron and steel for building is so rapidly taking the place of wood in large structures, the problem of arranging for such currents has presented to the architect and the electrical engineer a problem by no means easy to solve.

While much has been done in this direction, there can be no doubt that, in most cases, a satisfactory result is only reached by taking up the problem for the particular case entirely on its own merits and requirements.

Some of the difficulties are common to every building of "fireproof" construction, and are results, in part, at least, of the materials and methods of work necessarily used in such structures.

It is fair to assume that the most important point to be considered is that the introduction of the necessary ducts and insulated conductors shall in no way interfere with the specific purpose which the use of iron, steel, and masonry in place of wood is intended to produce, *i. e.*, the construction of buildings, which, *in themselves*, shall hinder or even overcome the spread of fire.

Another problem which is the result of this form of construction, and which is no less difficult of solution, is the necessity of providing during the construction of the building for all the conductors of electricity which are likely to be needed.

In a building constructed with brick or stone walls and wooden flooring, where the partitions are of wood or of plaster on wooden stud and lath, it is likely that there will be hollow spaces in which, with proper protection, the necessary additions can be made, or else the conductors can be attached to the exterior surfaces without unduly disfiguring or injuring the building. Where, however, the walls, floors, and partitions are of solid masonry, and steel or iron supports are used throughout the structure, no opportunity for such additions as may be desirable presents itself.

A third difficulty which is probably less understood at the present time can be directly traced to the effect which the materials used for concrete and plaster produce upon the coverings of electrical conductors in their various forms. No doubt every reader of this paper has in mind cases which have come to his knowledge, either directly or through the papers, where the conduits placed in fire-proof buildings have been entirely or in part destroyed by the action of these materials, and it is also probable that he has no distinct idea of the chemical processes which accomplished this destruction and the means which may be taken to prevent such action in the future.

In several cases which the writer has met, these problems have all occurred and have not been solved in a thoroughly satisfactory manner, and he hopes in this paper to suggest, at least, improvements on the methods which failed to produce the desired results.

In providing against injury to the fire-resisting qualities of the building it is absolutely necessary that in the construction of ducts and conduits no additional flues be made by which fire may pass from room to room, or floor to floor, and for this purpose it is essential that all such passages be provided for in the original plans of the building, or, if added during construction, be built of the same materials as the partitions through which they pass. It is too often the case that they are cut out of the walls and covered or built with wood without "fire stops" at the floor levels. In this connection it must be remembered that all insulating materials which can be applied to the surface of conductors are, from their nature, inflammable, and that they may be set on fire by the heat of the currents passing over the conductors.

We thus have the possibility that an electrical defect may develop a fire in a duct or conduit which will spread through a large part of the building on the materials and contents of the duct itself, and that the fire will be increased by the electrical disturbance which the flames produce.

Where the ducts are made a part of the original construction there should be no difficulty in making them as safe as a chimney, but architects should remember that the whole value of this method may be destroyed by adding to their contents steam, gas, or drain pipes added as an afterthought.

It will probably be said that the iron-armored conduit now so extensively advertised will meet this particular difficulty successfully, but in buildings where large main conductors are needed, the difficulty of placing them in the conduit is considerable, and the problem of connections by no means an easy one. Furthermore, where a large number of these tubes are brought together at one point, it is necessary to remove so much of the masonry as to injure its fire-resisting qualities, and where the point of junction is in a ceiling a serious weakening is likely to occur.

This form of construction is also liable to objection under the second head, that is, that with only iron conduit the possibility of change which is so necessary is not always found. An iron conduit cannot be properly used for more than two conductors; now, for lighting and power purposes this means that only *one* complete circuit is provided by each tube, and no considerable change can be made, while with a proper duct it is possible to add materially to the carrying capacity of the original main conductors and to have reasonable space in which to make the proper connections, which, with the tube system, are, as a rule, made in small cut-out cabinets or pockets in wall or ceiling.

The proper system for buildings of considerable size would seem to be a combination of the two systems with ample ducts for the mains and iron conduit branching to every point where current might be needed, and containing the smaller circuits.

The use of space behind a movable cornice has been used with advantage in some buildings, especially for such wires as are intended to carry currents for telephone, telegraph, or signal work.

In dealing with this problem the aid of the electrical engineer can be of the greatest service, for, while the architect and the mechanical engineer are, from their training, prepared to produce a building suitable in other respects for the uses to which it is to be put, the problem of where and how largely the electric current is likely to be needed is one which, with the rapid advance of science in this direction, needs special training for its solution. Above all things, however, architects, property owners, and builders should bear in mind the fact that the amount of current used, for instance, in a large office building may be during parts of the day the equivalent of two hundred horse-power, and should, therefore, provide facilities for arranging the main conductors at least in spaces where they can be accessible, and where additions can, if necessary, be made. Such spaces when used, say, for ventilation, are not considered unreasonable, but it is the exception when owner or architect provides, without protest, a duct 2 ft. square for electric conductors.

In connection with the third difficulty,— injury to conduits and conductors by materials of construction,— two facts should be kept constantly in view. First, the disintegrating effect of an electric current on all metals and conducting materials, termed electrolysis, and secondly, the constantly increasing tendency to increase the speed of construction by the use of quick-drying plaster.

Electrolysis takes place in a greater or less degree whenever an electric current passes from one conductor to another in the presence, and is often confounded with corrosion or oxidization, which is produced by such moisture.

(*To be continued.*)

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Continued.*)

THE CHEMISTRY OF CEMENTS.

THE question of the presence of alumina in a cement, its action and influence on the quality, and its mode of combination, has also been the source of much discussion by the authorities. The presence of alumina is due to the fact that silica, without which hydraulic cement has not been produced, is not found in quantities sufficiently fine except in combination with alumina, *i. e.*, in clay. And so it may be said to be an unwelcome accompaniment to silica in the composition of an artificial cement, while in natural cement it is inherent in the cement rock, being combined with the silica.

It is both basic and acidic in its character. In its combination with silica, as in clay, its action is purely that of a base. In this condition of silicate of alumina it is not decomposed by heat, as is demonstrated in the production of fire-brick from that material.

Taken in a pure state, alumina will combine with lime, forming aluminate of lime, thus proving its acidic character.

Its combining proportions with silica and lime, considered separately, are as follows:

Silica	63.83	Alumina	32.67
Alumina	36.17	Lime	67.33
Totals	100.00		100.00

The author has been furnished some beautiful specimens of aluminate of lime by Prof. S. B. Newberry, who produced them in his laboratory, and states that "they were practically fused at a bright yellow heat. A low temperature compared with that required to produce Portland cement."

The basic character of alumina exceeds the acidic, but it is so feeble that it is not capable of forming salts with weak acids, while its acidic character is also feeble and can only form compounds with strong bases.

These peculiar characteristics of alumina have led to a variety of opinions concerning its true position in an hydraulic cement composition.

Many excellent authorities assert that in a cement both silicate and aluminate of lime are formed. While others maintain that silica combines with both bases, lime and alumina, forming bi-silicate of lime and alumina.

Some of the advocates of each of these theories claim that magnesia, if present, remains inert in the cement, that is, free and uncombined. While others maintain that it combines only with the silica and lime; while still others maintain that it combines with the silica, lime, and alumina, forming a triple silicate.

It has also been stated by some eminent chemists that after calcination all the constituents, silica, alumina, lime, and magnesia, are in a free condition, and that it is only by the application of water that silicates are formed, some claiming that silicate of lime and aluminate of lime are thus formed; and by others that by the application of water the silica combines with all the bases present in certain fixed proportions.

Neither of these advocates are disposed to admit that water combines with and causes the crystallization of silicates already formed by the agency of heat.

While the analytical side of the cement question seems to be fairly well understood, it is apparent that the synthetical side has been neglected.

That neither magnesia nor alumina is absolutely essential to the fabrication of an hydraulic cement has been well demonstrated; but each is present, in greater or less proportion, in all cements, and it is interesting to note the theories advanced by our leading authorities in regard to the perplexing problems attending the presence of these two bases and their mode of combination.

The views of Prof. DeSmedt on this question, also those of Prof. Cox, are clearly expressed in the quotations already given, from their writings.

Leonard F. Beckwith, C. E., New York, in his report on the "Hydraulic Lime of Teil," page 23, says: "The method of manufacture strongly influences the composition of limes and cements. At a high temperature, silicate of lime and the double silicate of lime and alumina are formed. At a low heat, the double silicate is not formed, and the alumina, acting towards the lime the part of an acid, produces aluminate of lime," and that "the latter is weak and the first element to become decomposed in sea-water."

Henry Reid, C. E., London, in his work on "Portland Cements," ed. 1877, page 151, says: "Alumina, when in excess in a clay, impairs the indurating value of the cement in the making of which it is used. Aluminate of lime possesses excellent hydraulic properties, but the temperature necessary for its formation is much higher than that at which silicate of lime is produced.

"If, therefore, a clay contains an excess of alumina, part of the silicate of lime will be overburnt before the whole of the alumina can enter into combination with the lime."

Prof. S. B. Newberry in "Mineral Resources of the United States, 1892," page 746, says: "Cement possessing hydraulic properties is always obtained when a mixture of carbonate of lime and clay, in proper proportions, is strongly heated. Although this operation appears very simple, yet the chemical reactions which take place in the burning and hardening of cement, and the chemical nature of the cement itself, are still more or less obscure. Le Chatelier has shown, perhaps conclusively, that the essential constituent of Portland cement, burned at high temperature, is a compound of silica and lime, probably of the formula $3CaO.SiO2$. The alumina and oxide of iron of the clay appear, therefore, to play an unimportant part in the hardening of cement. Nevertheless, Le Chatelier failed to obtain the trisilicate on heating lime and silica together, a mixture of lower silicates (bisilicate) and free lime being always obtained. It is evident, therefore, that in order to produce complete combination of the silica and lime at the temperature of the cement kiln, some other substance, such as alumina or iron oxide, must be present to act as a flux. By fusion with the oxyhydrogen blowpipe, however, the writer has lately succeeded in bringing pure silica and lime into combination in the proportion required by Le Chatelier's formula, obtaining a product which showed all the qualities of good cement. It appears, therefore, that the possibility of making cement from silica and lime alone is only a question of temperature. As to the part played by the alumina and iron oxide of the clay, it is interesting to recall that Dr. Schott long ago found that the alumina in cement mixtures can be completely replaced by oxide of iron, or the oxide of iron by alumina, without injury to the resulting product. He thus obtained cements containing only silica, lime, and alumina, and equally good cements containing only silica, lime, and iron oxide, showing that alumina and oxide of iron act in a precisely similar manner.

"The exact way in which the alumina acts in promoting the combination of silica and lime is, however, still more or less uncertain. Le Chatelier considers that in the burning of cement the silica and alumina first combine with a small amount of lime, forming a fusible glass, and that this gradually takes up more lime, becoming more and more basic, and at the same time less fusible, until finally the all-important trisilicate, which is the essential constituent of cement, is produced. Le Chatelier has, however, shown that alumina and lime form exceedingly fusible aluminates, especially when the lime is present in large proportion. In view of this fact, it seems to the writer much more probable that a fusible aluminate is first produced, and that this is then gradually decomposed by the silica with the formation of the trisilicate, the alumina finally remaining in combination with a comparatively small proportion of lime. Substantially the same view has already been advanced by Michaelis. Experiments now in progress under the writer's direction are expected to throw light on this interesting question. . . . .

"It is well known that in making Portland cement the proportions of basic and acid constituents (lime and clay) must be almost absolutely constant, the best results being obtained with from 2.8 to 3 parts of lime to 1 part of silica. In natural rock cement, if the magnesia be disregarded, the clay will generally be found to be very greatly in excess, the proportion of lime to silica not usually exceeding 1½ or 2 to 1. At the low temperature at which the natural rock cement must of necessity be burned, it is probable that the chief reaction which takes place is the combination of the alumina with the lime, and that most of the silica remains uncombined. The quick setting properties of hydraulic cement accord closely with the behavior of calcium aluminate, and indicate that the latter is the active constituent in cement made from natural rock. The progressive hardening of this cement under water and the great strength which it often ultimately attains may be explained by the gradual action of the amorphous silica present on the aluminate, an action similar to that known to take place between the silica of pozzuolana, slag, etc., and slaked lime."

(*To be continued.*)

EMERY is one of the few valuable rocks not yet produced in important quantities in America. Large amounts are yearly brought from Turkey and the Greek Islands, where it has been quarried since history began. Its wonderful properties were no secret to the ancients, who used it for cutting and polishing; but their methods of working are not certainly known. Curiously, modern schemes for mining this substance have made no progress, and to-day ledges of emery are heated by huge fires, and the hot rock cracked by douches of cold water, as in the days when Athens and Sparta struggled for Syracuse.

During the middle ages, and for many years afterwards, the properties of emery, while not forgotten, could not be utilized. The old art of working was lost, and ingenuity was unable to give useful forms to this intractable substance. It defied every effort. Slowly, however, emery came into use, first as a polishing and cutting powder, and later, in small grains, was attached to fabrics like a sandpaper. Means were then found to cement and mold its small particles into wheels. Emery wheels soon came into use, for their remarkable cutting properties proved at once the great industrial importance of the invention.

Years elapsed, however, before the *emery millstone* could be made; but at length this, too, was accomplished, and a practical emery stone was brought out in England. But later Yankee ingenuity improved upon this and produced the present successful Rock Emery Millstone, which is built up of large blocks of emery set in strong metal.

These millstones are able to grind anything. They grind fast, because the emery face is always sharp, and they can be run at high speed (not being damaged by heat), and thus would be capable of doing more work than any other form of grinder, even if the cutting properties of emery were less remarkable. Emery millstones are economical, because, while not much more expensive than other millstones, they are as much more durable, as emery surpasses other stones in hardness. Many new uses will doubtless be found for emery, which for ages has held to rocks the same unique position that the diamond has to gems; but probably it can take no more important place than that of the emery wheel and the emery millstone, — the one cutting and polishing in the shops the hardest surfaces, and the other grinding everything that can be ground to any degree of fineness, and with a new economy.

IN the King Building, at the corner of Milk and Broad Streets, Boston, the architect, William Whitney Lewis, having to build an iron staircase of several flights, and not wishing to use marble or slate treads on account of the comparatively large expense of the same and the more or less slippery quality of these materials after a little use, decided to have the iron treads made in shallow pan shape with ribs spaced about 2½ ins. apart in both directions with the tops of the ribs about one fourth below the rims of the pans; the pans were then filled with equal parts of best Portland cement and sharp sand trowelled down to a smooth surface. The treads thus made promise to be durable, are almost noiseless, afford a firm foothold and can be easily and quickly repaired or patched in case of wear or injury by accident; in case of wear in the middle of width of tread, only so much of tread as is worn down need be replaced; a marble or slate tread would, of course, have to be replaced with a full-sized tread.

A SPECIES of construction is coming to us out of the West which, while perhaps not answering all conditions, certainly is a very promising one and affords wide opportunities. The use of concrete in some of the California buildings, and to a very limited extent throughout some of the Eastern States, is novel, daring, and so far very successful. The scheme of a monolithic house built of concrete from foundation to turret has been experimented with a great many times. Much of the prejudice which exists in some minds against the use of concrete arises from the fact that the material has not been employed intelligently, and that a good building construction has suffered by being confounded with a poor system which uses the same basis. It is perfectly possible to build a structure which shall be fire-proof, light, strong, and relatively inexpensive by using concrete throughout with no more iron than is in the shape of a few twisted rods. For many purposes this construction is admirably adapted, and if it is used in the future as intelligently as it has been in the best instances in the past we may look for a large expansion in monolithic construction.

THE ESSENTIALS OF GOOD PORTLAND CEMENT.

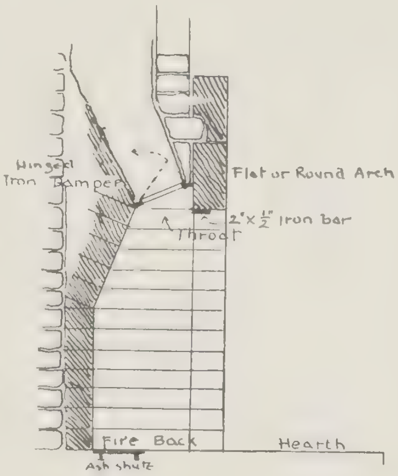
AT a recent meeting of the Society of Engineers a paper on Portland cement was read by Mr. D. B. Butler. The author stated that the chief chemical components of a good cement ranged as follows: — Silica from 20 to 28 per cent., average 24 per cent.; oxide of iron and alumina from 8 to 14 per cent., average 11 per cent.; lime 58 to 65 per cent., average 61.5 per cent. These ingredients constituted about 96 per cent. of the whole, the remainder being made up of small proportions of magnesia, sulphuric acid, alkalies, etc. With respect to soundness, the usual test is the molding of a thin pat with a minimum of water. This pat is allowed to harden on a glass slab, which it should do without cracking. This, the author states, is not altogether reliable, as he had known cases where, though the pat remained sound at the end of seven days, it went to pieces later on. He therefore advocated Mr. Faija's test, which consists essentially of subjecting a freshly gauged pat to a moist heat of 100 degs. Fahr. until set, and then placing it in warm water at 115 degs. Fahr. for twenty-four hours. A pat which stood this test without blowing showed a reliable cement. The edge-runner mills, which were now being largely substituted for stones, did not, he considered, give so large a proportion of the impalpable powder, which is the essential part of the cement, so that a cement ground by stones, and leaving a 10 per cent. residue on a 50 by 50 sieve, was equal in cementitious value to one ground in an edge-runner mill, leaving but half as much residue on the same sieve. From a number of experiments Mr. Butler concludes that the time of setting is less the higher the temperature. Some of the samples tried, when mixed at 80 degs. Fahr., set in half the time required at 40 degs. Fahr., and with other specimens the difference was even greater, and the result was of the same character whether the specimens were tested for initial set or for set hard.— *British Clay Worker.*

The Masons' Department.

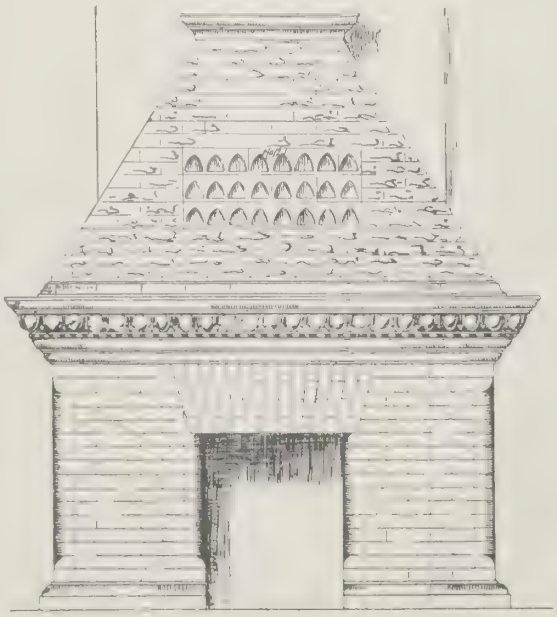
Conducted in the Interests of the Mason and the Contractor for Brickwork.

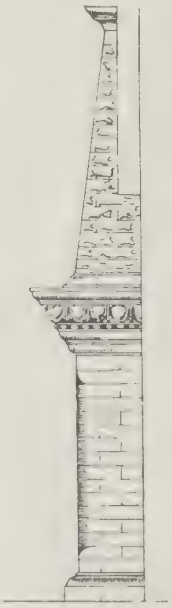
BRICK MANTELS.

BRICK mantels and fireplaces have found much favor with home builders and also with owners of more ambitious buildings. Bricks are susceptible of such a variety of combinations that they may be made to express almost any desired effect of form or color. The same bricks which we see so aptly used in the mantel of a sumptuous town hall or library take their places very happily in the cozy home nook. Bricks are the most versatile building material in existence, and their use in the erection of the shrines of our homes seem a natural selection. The greater responsibility of the appropriate use of this subtle material in harmonious accord with its surroundings of course falls upon the designer, but also very much depends upon the mason who carries out the designer's ideas. All the beauties of form and color are set at naught when a fireplace indulges in the luxury of smoking. If the mason has not done his work well he may be the guilty party. At any rate, he should understand all the requirements of a healthy fireplace as well as laying it up in the most effectual and durable manner.

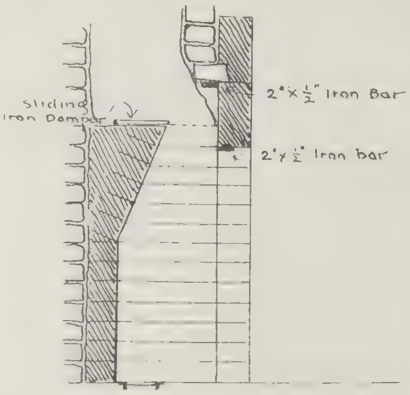


Many designs depend upon the technique, so to speak, of bricklaying; not only a skilful hand but a good head is essential to success in this branch, for the mason must know how to read a drawing and see around a corner, as it were, to imagine and supplement the data represented on a drawing with common sense, — and he must see what a drawing sometimes cannot express. A mason ought to be able to draw. The new Architectural Department at Harvard College has among its students several builders' sons who do not expect to be architects, but think that as builders they should have an architectural training. They will make the most intelligent builders. The prospective mason would do well to work awhile, at least, in an architect's office.





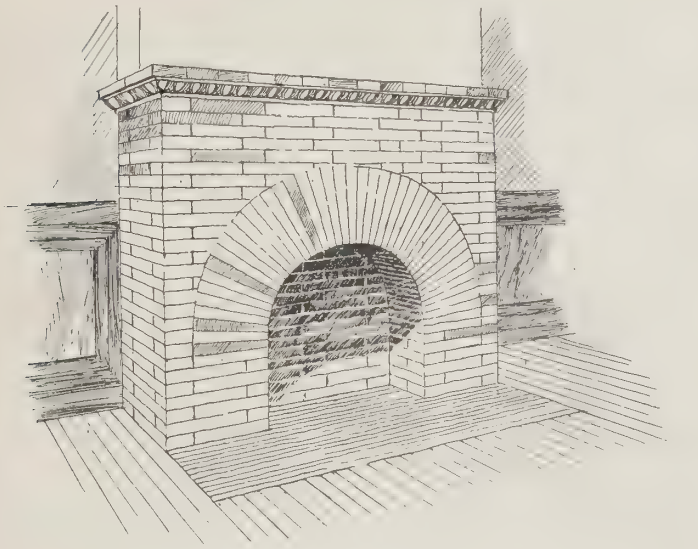
It may not be amiss to review the process of laying up a fireplace and mantel, calling attention to a few of the vital points. In the first place, the finished fireplace should under no consideration be built until the plastering is finished. A careful examination of the drawing is the first step. The rough chimney being already in place around which the finished fireplace is to be built, the mason should take measures and consider how his design will fit the rough work. If a serious amount of cutting of the rough work is necessary or any change required in the design, the mason should consult the architect if he desires a peaceful existence. In case of a low mantel or a brick facing, he will find, in properly constructed work, that the carpenter has built his furrings above the fireplace opening not lower than 4 ft. high from the floor. A rough brick fireplace opening is generally built 3 ft. 6 ins. high. He should investigate the supports and the trimmer arch for his mantel, and see that the former is sufficient and the latter wide enough, and if not, he should report to the interested parties. Although, strictly speaking, he has nothing to do with the smoke flue to his fireplace, he should have enough pride in the successful operation of his production when completed to examine if there is need of improvement of its accessories. A flue for a first-story fireplace, in the best work, is 8 ins. by 12 ins. plastered inside, or has a terra-cotta lining. A flue 8 ins. by 8 ins. for a small fireplace is often made to answer if perfectly smooth. For a second-story fireplace of a dwelling house, 8 ins. by 8 ins. is ample. A very large fireplace will require larger flues than here mentioned. Fireplaces vary to such an extent that it is not practicable to give any fixed rules as a guide. It is generally understood that the height of fireplace openings from 2 ft. to 3 ft. 6 ins. in width should not be more than 2 ft. 6 ins., or 12 courses in brick, and the depth 20 ins. The average fireplace, when wood is to be used, is about 3 ft. wide, 2 ft. 6 ins. high, and 16 ins. deep. The splay of the jambs depends upon the width of the opening. The width of the back should admit of the use of 2 ft. wood. It is advisable to give a very broad fireplace widely splayed jambs. For instance, if the opening is 4 ft. wide, make the back 2 ft., and the jambs would splay 1 ft. each. This permits the fire to radiate its heat and the splays act as reflectors, and the effect is also pleasing.



The rough work is first levelled up and the outline of the mantel and fireplace is drawn on this floor. In case molded or carved bricks are used this preliminary work should be very carefully done.

The catalogues of Sayre & Fisher Co., Fiske, Homes & Co., Philadelphia & Boston Face Brick Co., and Peerless Brick Co., contain illustrations of brick mantels with descriptions of same, that would be of much value to a mason wishing to post himself upon this subject.

The accompanying drawing shows a section of a fireplace. The hearth of bricks or tiles should never be less than 16 ins. width, this dimension depends upon the size of the opening. Hearths are more often built too narrow than too wide. The latter condition is to be desired. Two ft. is none too wide for a hearth for the common run of fireplaces. The hearth should extend at least 1 ft. each side of the fireplace opening. Black tiles form a good under fire. Where an ash pit is provided, an ash door with cast iron rim is placed at the back of the fireplace. In laying up a brick facing the mason should give particular care to the joining of the facing to the rough brickwork above the opening. This is its vulnerable point. Defective work would perhaps permit sparks to enter the wood furring above. In best work an angle iron is used to support the lintel or flat arch above the opening, the iron being let into the under side of the brick, forming a flat soffit. A 2 in. angle iron is used for a 3 ft. opening and a 3 in. angle iron for a 4 ft. opening. The rough brickwork should also be supported by similar angle irons. There are several varieties of iron dampers in the market; the diagrams show two kinds, one resting on the brick shelf formed by the sloping back, which slides backward and forward to open and close, and the other hinges at the back with a register slide on the face. There can be no fixed rule for the size of the throat. It is commonly made from 6 ins. to 8 ins. in width and the length of the fireplace opening, a wide and deep fireplace naturally requiring a wider throat. Then a long flue with a strong draft would have a narrower throat. The minimum of throat area which will answer the purpose, of course, economizes heat. The thickness of the arch at the top of the opening should never exceed 4 ins. at the soffit. The top of the slope of the back should be level with this soffit, and inclining the damper forms a slight pocket which prevents the smoke from curling out into the room. In a pressed brick mantel ⅛ in. mortar joint looks well. The mason should, however, space his vertical joints in case the top of mantel or of belts in his design are to line with any adjoining object. The mortar can be colored red by using colorific, or any desired shade, obtained by the use of earth pigments. A brick with white joint may not harmonize with the color of the room in which it is to be placed, but by coloring the mortar the tone of the mantel may be brought to harmonize with the decoration of a room. This is a matter of arrangement on the part of the designer, and the mason will do well to consult him before laying up the work. Cement is usually added to the mortar which takes away the whiteness of lime mortar. The hearth should always be laid in cement mortar.



After the mantel is finished its surface should always be washed with solution of muriatic acid and water.

NO one material is used so extensively in building operations as brick, and if experience were to count for anything, constant usage ought to lead to perfection in methods, whereas, the fact can hardly be denied that most brick masonry is laid in a manner which shows a lack of appreciation of fundamental principles on the part of our masons. There seems often to be a vague idea that if the bricks individually are well burnt and are laid up with a good bond, the wall is pretty sure to be a good one. The hardness of the brick and the character of the bonding certainly are important factors, but the weakness of the wall is more often due to the quality of the mortar and the manner in which it is used. The quality can be governed with pretty reasonable surety, and is a matter of good intent, but the good usage is in this country more honored in the breach than in the observance.

The best masonry construction which the world has ever seen was executed by the Romans. They were past masters in the use of brick, stone, and especially mortar, and their descendants of to-day keep up the old traditions, laying up walls of brick and rubble stone which, in respect to the use of the mortar, are hardly excelled anywhere. Their success lies in the use of the mortar which is employed very freely. In fact, the mortar is considered simply as a matrix and the stone or brick simply as a filling, so that the wall when completed is practically a solid mass of mortar with bricks or stones bedded in it at frequent intervals. With us the custom is apt to be just the reverse, — a brick wall consisting of an aggregate of slices of brick tied across at intervals with thin joints slightly filled with mortar. If the brick masons will once get the idea firmly bedded in their minds that the mortar is the principal thing in the strength of a wall, and not the brick itself, and could remember, furthermore, that it is of far more importance that every space should be filled solid with the mortar than that the joints of the brick should be absolutely even or especially small, there would be little difficulty in producing thoroughly first-class work.

The strength of a chain is measured by the strength of the weakest link, and the strength of a brick wall which is laid up in mortar can be no greater than the mortar itself no matter how hard the brick is. We are rather accustomed at times to consider the modern Italians simply as good laborers. If a few of the Roman bricklayers could be imported to this country and given the same opportunities they have abroad, they would lay up walls which would be a revelation to some of our bricklayers. Keep the bricks wet, slush in an abundance of mortar, and see that all the joints are filled and the bricks rubbed in, and, above all, carry up the different courses together, and a 12 in. brick wall built in this way will be stronger than a 20 in. or 24 in. wall put up in the usual manner. Even in a building of skeleton construction wherein the steel work is relied upon to secure the whole building, the character of the masonry is of great importance and the stiffness and durability of the envelope is affected a great deal by the manner in which the mortar is used. In other words, a brick wall to be thoroughly first class in its construction should be monolithic, like a mass of concrete, and the adhesive qualities of good mortar are amply sufficient to bring about this condition provided the joints are made thick enough and every space in the wall is filled full. Every specification calls for the joints to be well filled, and every foreman will claim they are filled, but we all know they are not.

In connection with this subject a practise that is very common among masons should be noticed. In setting plates for iron columns a level bed is usually cut on the top of the stone footing which is roughly brought to a little below the exact level at which the bottom of the plate must rest. A plentiful layer of mortar is then spread over the stonework and the iron plate is directly bedded therein. It is hard work to persuade most masons that this practise is wrong. If the plate is proportioned for the resisting strength of mortar no harm is done, but the plates are usually proportioned for the resisting power of the granite, and there is consequently interposed between the granite and the iron a layer, more or less irregular, of a material which has less than one fourth the resistance of the stone, and to make the matter worse in some cases the plate is even wedged up with slate chips if the mortar is a little thin on one side. The proper way is for the iron to bed directly upon the stone without any interposition, but we doubt if there are many buildings in which this is done. It is so much easier to spread a layer of mortar and fill up the space that only the most careful supervision and insistence upon the exact cutting of the stone will secure the desired result.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

CHICAGO. — Hopes for the future are influenced by results in the past. With the incoming of the New Year, therefore, it is the fashion to balance the books and find out what has been accomplished during the year. The daily papers on New Year's morning were bulky with extensive reviews and statistics of all branches of industry, from pork packing to painting and sculpture.

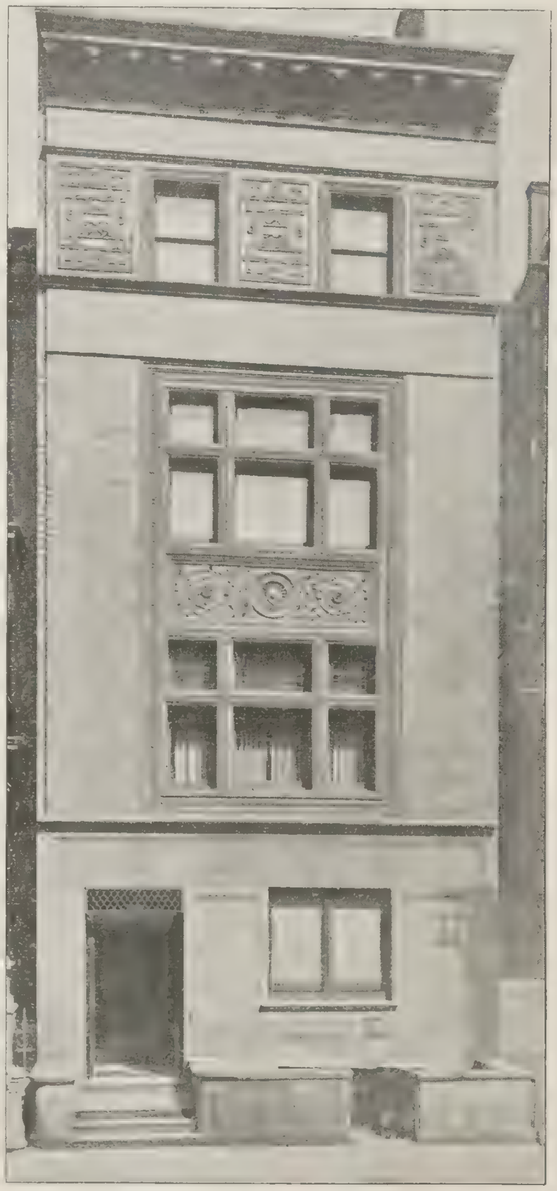
Building statistics in Chicago, like building ordinances, are not altogether reliable. Houses costing $4,000 sometimes go on the records at $2,000, and the total cost record may be 10 per cent. or 50 per cent. too low. The frontage of buildings erected in Chicago during 1895 is computed to be thirty-nine miles, a little less than in the preceding year, but in cost ($35,000,000) somewhat greater than the estimate for 1894.

Lumber statistics seem to agree with the above. Total sales in the Chicago market for 1895 are given as 1,760,000,000 feet against 1,626,000,000 feet in 1894. But that building activity since the panic is below the normal can be judged from the common brick consumption, which is said to be annually 800,000,000. In 1895 only 450,000,000 were used. The interesting thing about pressed brick is the fact that of the 30,000,000 used here last year only a small fraction were made in Chicago. No figures are at hand concerning terra-cotta and hollow tile, which Chicago supplies to herself and the country on a large scale. But even in this particular a few coals have been brought to Newcastle.

Of the quick building records during the year the Atwood is an example. Possession was given to begin tearing down the old building May 1. On October 1, five months afterward, the roof was on a ten-story building, and the first story was given over, mosaic floors and all, ready for opening a store. Another building was an eight-story structure, 125 x 100 ft. in plan, which was put up in sixty days for a bicycle factory.

The *Economist* makes the startling statement that it has reliable information to the effect that 90 per cent. of the buildings in Chicago are put up without the aid of recognized architects. This is a welcome statement as far as it helps to excuse architects for much bad work, but it is unwelcome if it is a correct statement of the respect and confidence which the profession has won for itself.

Speaking of prospective work in architecture, it is reported that the Czar Nicholas of Russia has ordered the erection of a Greek cathedral in Chicago which is to cost a half million.



BRICK AND TERRA-COTTA FRONT, 33D STREET, NEW YORK.
McKim, Mead & White, Architects.

J. J. Egan is the architect of a Catholic church to cost $100,000, and which is to have stone front and pressed brick sides.

There are two or three office buildings booked for the near future. Jenney & Mundie will be ready soon to let contracts on one of ten stories which is to stand at Randolph Street and Wabash Avenue.

A notable transaction lately was the purchase by a syndicate (composed in part of Holabird & Roche and a well-known contractor) of a tract of land at 34th Street and Cottage Grove Avenue, the site of the old University of Chicago. The improvements will be forty-four four-story apartment buildings, costing about $1,300,000. The buildings are to be isolated and will contain about 350 suites of two to eight rooms each. Back stairs will be enclosed and there will be hand lifts. The exteriors of the buildings will vary in design and be brick with stone and terra-cotta trimmings.

Mr. Richard E. Schmidt has been commissioned to design a $200,000 hospital for the Alexian Brothers, who have to leave their present quarters on account of the encroachments of an elevated railroad.

The Architectural Club had a good time one night before Christmas. Some of the veteran members tried to show the boys how to celebrate, and they certainly succeeded. The writer left at midnight and hence saw only half the fun. The first half had, as "soup," informal conversation and long-stemmed pipes (furnished and filled by the hosts). The "fish" came when a procession filed out to the barn at the rear of the club house and danced with ever increasing jollity around a fake Christmas tree. When the well-decorated guests marched back into the club house they found the parlors occupied by well-laden tables, and here they enjoyed the "entree." The supplies were fine and "unlimited," but enthusiasm never flagged until every platter was clean and every bottle empty. A little spice taken at this time with some salt was a poem read by the well-known German clay poet, Fritz Wagner. A "side dish" which became a center of attraction and loosened many tongues was a ruby stream flowing from a painted bowl, an ingenious and handsome piece of work by Mr. Mundie. Music wafted its harmonious influence over this many-coursed banquet, and, judging from all accounts, the "dessert" at 3 A. M. was highly enjoyed.

NEW YORK. — The year just closed has been one of the most successful in the history of building in New York. Owing to the cheapness of labor and material, and also, perhaps, to favorable changes in the building laws, a large number of plans were filed early in the spring, and the activity rather increased than abated as the year went on. A very large portion of these buildings have been of the steel frame type.

On Broadway and Anne Street George B. Post is building for the Havemeyers a twenty-five-story office building in the French style, of brick and cut stone. The foundations are now in, and they have an unusually solid look. An interesting innovation is introduced in this construction. The steel columns of the exterior walls are placed entirely behind the brick piers, and at each floor there is projected from the columns a steel bracket to carry the I beams which support the curtain walls.

Another large building now in course of construction is the Siegel-Cooper building, De Lemos & Cordes, architects, which is to be one of the largest retail dry goods shops in New York. It is to be principally of brick, steel construction, with cast-iron uprights, and is to have a frontage of 180 ft. on Sixth Avenue, and 460 ft. on 18th and 19th Streets. The end system of fire-proofing is used. Some delay has been caused because possession could not be obtained of the small houses on the corner of 18th Street and Sixth Avenue until the leases expire in May; so that the part of the new work which is to occupy this site must remain undone until then.

Hammerstein's Olympia, recently finished, is one of the largest buildings of the year.

It is of very handsome white stone, profusely carved. It was designed and built by J. B. McElfatrick & Son, who have built a great number of theaters throughout the country, and has been rather severely criticized.

It is fire-proof throughout, faces on Broadway 206 ft., and 156 ft. on 44th and 45th Streets, and is 96 ft. high. It contains a large music hall, concert hall, and a theater, besides many lesser rooms for billiards, etc. There is also a roof garden, and a Turkish bath and barber shop in the basement.

J. Stewart Barney is the architect of an eight-story steel frame brick and terra-cotta building on 28th Street and Broadway. Peter Tostevin & Son are the contractors.

The Ireland Building, which collapsed so disastrously last summer, has been entirely removed, and a new building is being put up by Hill & Turner. Mr. Hill is a well-known engineer, and this time the building will no doubt be put up right.

MINNEAPOLIS. — There is almost nothing being done or even talked of for next spring just now, and it will probably be so for another month. There are rumors in the air, as is usual, at this quiet period, and they will assume definite shape by February 1st. Among the future improvements are a six-story wholesale block, approximately 200 x 200 ft.; several churches, school buildings, and it is given out that $50,000 will be spent in residence improvements at Linden Hills, which will be our finest suburb in a few years, beyond question.

Among the new projects already assured, and in some cases partially carried out, may be mentioned the following: —

Public library and dining hall at State Hospital, Rochester, Minn. W. B. Dunnell, architect.

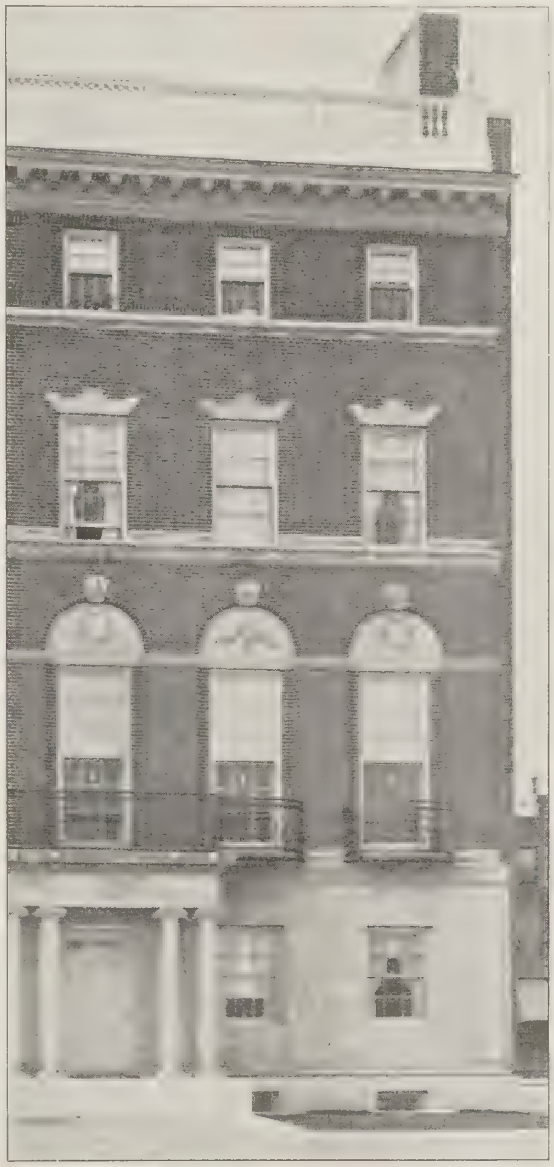
Fourth State Insane Hospital at Anoka, Minn., after plans by W. B. Dunnell, of this city; estimated to cost $75,000.

Northeast wing of State Insane Hospital, at Fergus Falls, Minn.; 50 x 174 ft., four stories and basement, fire-proof throughout. Plans ready for estimating about Jan. 15, 1896. Cost, about $90,000. W. B. Dunnell, architect.

St. Cloud, Minn., will probably build a court house in the spring to cost $100,000, the present building having been condemned by the grand jury.

L. M. Stewart, of Minneapolis, will build a public hall and library as a gift to his native town of Corinna, Me. Plans have been prepared by W. H. Grimshaw, architect, of Minneapolis, calling for a building 89 x 89 ft., two stories high, of brick, to be fire-proof, and to cost $35,000. The foundation is already in, and work will begin on superstructure in the spring.

Long & Kees are at work on plans for a three-story flat building, to be erected at corner Hennepin Avenue and 15th Street. To be of brick, with stone trimmings, and to contain thirty-six apartments. Plans ready for figures in January. Estimated to cost $60,000.



RESIDENCE OF RICHARD OLNEY, ESQ., BOSTON.
McKim, Mead & White, Architects.

In St. Paul the following are reported: —

Public library for Michigan City, Ind.; 40 x 80 ft., two story, fire-proof throughout, to cost $30,000. Reed & Stern, architects.

Representative Kiefer will introduce a bill in the House, appropriating $200,000 additional for the new public building at St. Paul.

Architect Cass Gilbert says the capitol plans will not be ready for estimating before April 1, next.

Herman Kretz & Co. have plans for a flat building to be built on the hill; 42 x 81 ft., three stories and basement, to contain six apartments, and to cost $35,000.

DETROIT. — At this time of the year business, especially the building business, usually slacks up; but it is not so in Detroit this year.

Hardly a day passes but what some manufacturer drops into the city for the purpose of securing a site for a factory.

"I don't understand why people will talk about conservatism in connection with Detroit's unparalleled advantages as a manufacturing point," said a leading real estate dealer the other day.

"Within the last four years manufacturers with a combined capital of over $200,000,000 have begun industries in the salt district."

And I believe myself that there is not another spot on earth that can make the same showing.

Geo. T. Abrey will build a twelve-story hotel of fire-proof construction. Plans are now being gotten out, and the building will probably be started at once.

A $40,000 addition will be made to Walker's brewery.

The Detroit Photochrom Company, a new corporation, with offices in the Hammond Building, will build a $100,000 building in the western part of the city.

No plans have been ordered as yet, but works will be commenced as soon as the weather will permit.

District No. 2 will build a new school, to be constructed of brick, at a cost of $40,000. The new school will have twelve rooms.

Detroit is to have the biggest and finest Turkish bath establishment in the United States. Gabriel Chiera is the enterprising citizen who will build and operate it.

It will be built on Farren Street, opposite the public library; will be seven stories high, of colonial style of architecture, and will cost about $150,000.

In its completeness it will be unsurpassed by any in the country, and, in fact, will be the only building erected exclusively for that purpose, with the exception of a small one on Murray Hill, New York City.

Architect Thomas Hyland is preparing plans of a Baptist church to be built in the city of Campos, State of Rio, Brazil. In ordering the plans, the pastor, the Rev. Solomon L. Ginsburg, specified that only brick and terra-cotta be used, as it is his intention to construct a modern building of the style of architecture used in the Northern States of North America.

The supervisors have at last settled the matter of building the new county jail.

The plans of John Scott, with certain modifications, were adopted, and all local builders will have an opportunity to bid on the structure.

The Bricklayers' and Plasterers' Unions asked that only union men and residents of Wayne County be allowed to work on the new rail.

Sam'l Goldwater made a speech in reply, and after he had finished the resolution was adopted.

The Detroit public building will have the finest court room contained in any of the federal buildings of the entire country.

W. H. Ashwell & Co., architects and civil engineers, have prepared plans for a large brick building to be used as an armory for the Michigan Military Academy. It will have a frontage of 150 feet by 50 feet in depth.

The Detroit Wheelmen hope to be installed in their handsome new club house by the first of August, which is to be built on Adams Avenue at a cost of $35,000 or $40,000.

TALL BUILDINGS

DEFENDED AGAINST THE THREATENED LEGISLATION LIMITING THEIR HEIGHT.

REFERRING to the "height of buildings," and resolutions proposed by the New York Chamber of Commerce anent the same, I have before me "A Law Limiting the Height of Dwelling Houses," passed in 1885. This was inoperative, because there was no penalty for any violation. The constitutionality of the act itself has not been tested. Men have always owned land from the center of the earth to the sky. Owners of property have common law rights and constitutional rights as well. The committee seems to think that the erection of "sky-scrapers" will outrun all limits of discretion.

But there is a law of "demand and supply" which is far more potent than any committee or resolution or legislative enactment.

No owner is willing to invest millions in a "sky-scraper" if all around his plot are similar ones which find "existence," or the income from rents, falling below the mark.

There are cases where a handsome bonus has been paid for the use of surrounding light and air to tall structures.

So that there is no fear we shall (here in New York, at least,) ever get too many tall buildings.

Now about the construction. The committee cites the Park Place Building as an example of what might happen in the future use of such tall buildings when loaded with machinery. But the conditions are not the same.

One was an ordinary wooden-beamed building, badly anchored and improperly loaded. The modern steel-cage construction is a rigid unit, all riveted together and possible to sustain vibratory motion without disintegration.

Much discussion has been quoted about danger from fire, outside as well as inside, the poor Manhattan Bank Building coming in as a "shining" example. But this never was, and never could be, classed as an example of fire-proof construction.

Iron alone does not constitute fire-proof construction. It must be scientifically disposed to accomplish this, and it has been so disposed in other buildings. There have been fires in these tall buildings (the "McIntyre" just comes to mind) where the fire has been confined to its primary limits.

Regarding the so-called defects of steel structures not being ascertained after enclosure in masonry, the committee has touched upon one of the strong points of steel-cage construction, because this system uses small members, each subject to rigid examination and test before leaving the shop, whereas cast iron may contain flaws which only assert themselves when failure comes.

It is a well-known fact that wrought anchors have been taken from the Coliseum at Rome, which were embedded in solid masonry, and when cut upon the anvil showed the same gray texture as when fresh from the forge.

Architects know how to protect their buildings from both fire and rust if the owners will pay for protection. But New York is an island and land is precious. In very few cases will a building below thirteen stories be found to pay, and its ability to do so is greatly dependent upon plan or convenience of arrangement, construction, and proximity to other tall buildings; this last cannot be accomplished by resorting to legislation.

Wind-swept as our great city is, there does not seem to be such a menace to health as the committee suggests.

Tall buildings will continue to spring up as long as there is a demand for them. What should be done is to eliminate the use of wood as much as possible, and where its use is imperative to so treat it that fire will not consume it. It is quite probable that owners of existing tall buildings might be glad to see a law enacted which should limit the construction of similar buildings. But this would be selfish, and as has been shown, difficult to pass. It is again reiterated that the needs and desires of the community will be found much more potent for its common good than ill-advised legislative restrictions.— *George Martin Huss in the New York Sun, January 10.*

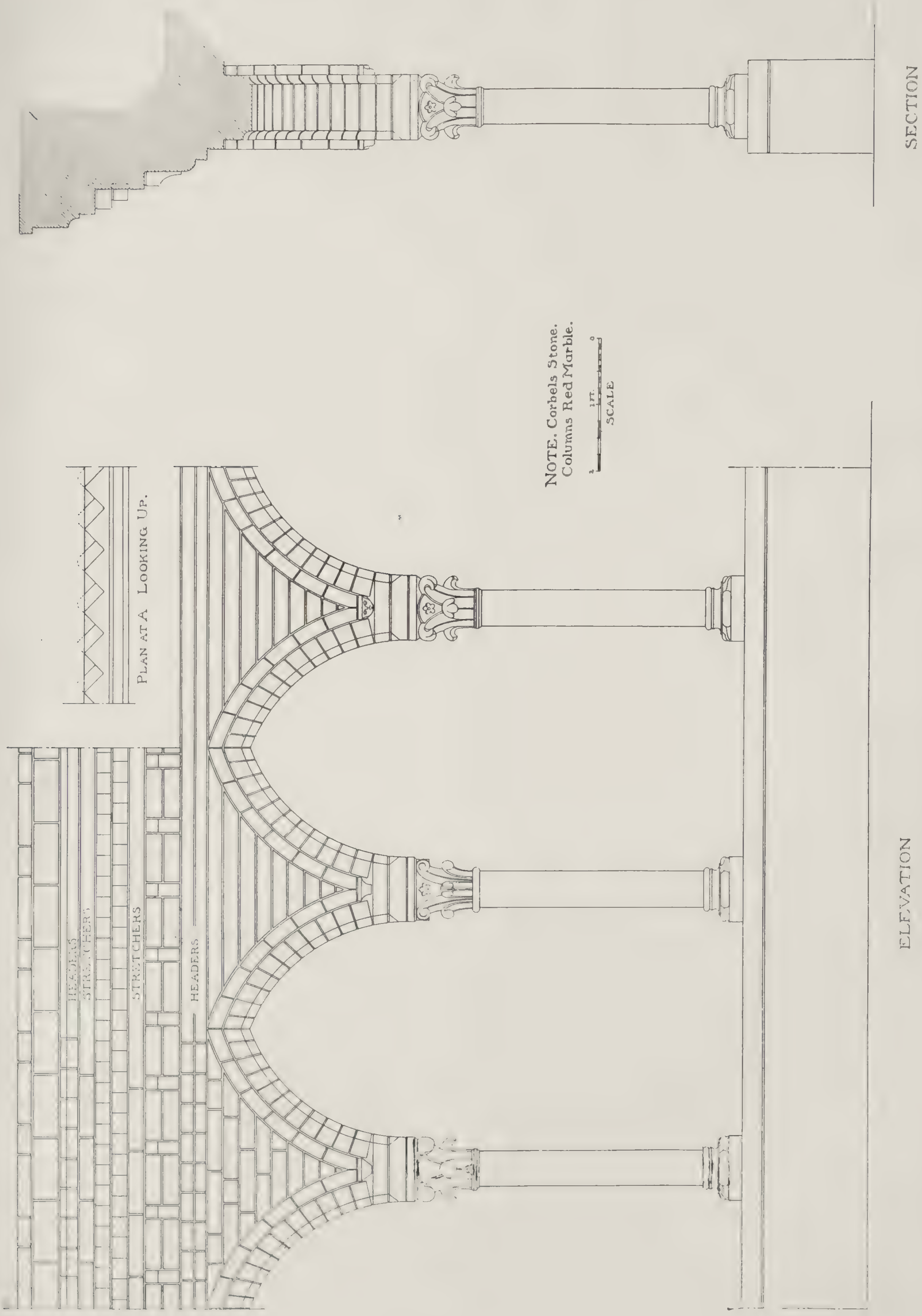
THE new office building of the Mutual Life Insurance Company of New York that is to be erected on Chestnut Street, Philadelphia, will be built of cream white bricks, Roman shape, same being furnished by The Powhatan Clay Manufacturing Company, of Richmond, Va.

THE illustration published in our December number, as the Lincoln Town Hall, should have been entitled Town Hall, Billerica, Mass., of which H. Langford Warren and Lewis H. Bacon were the architects.

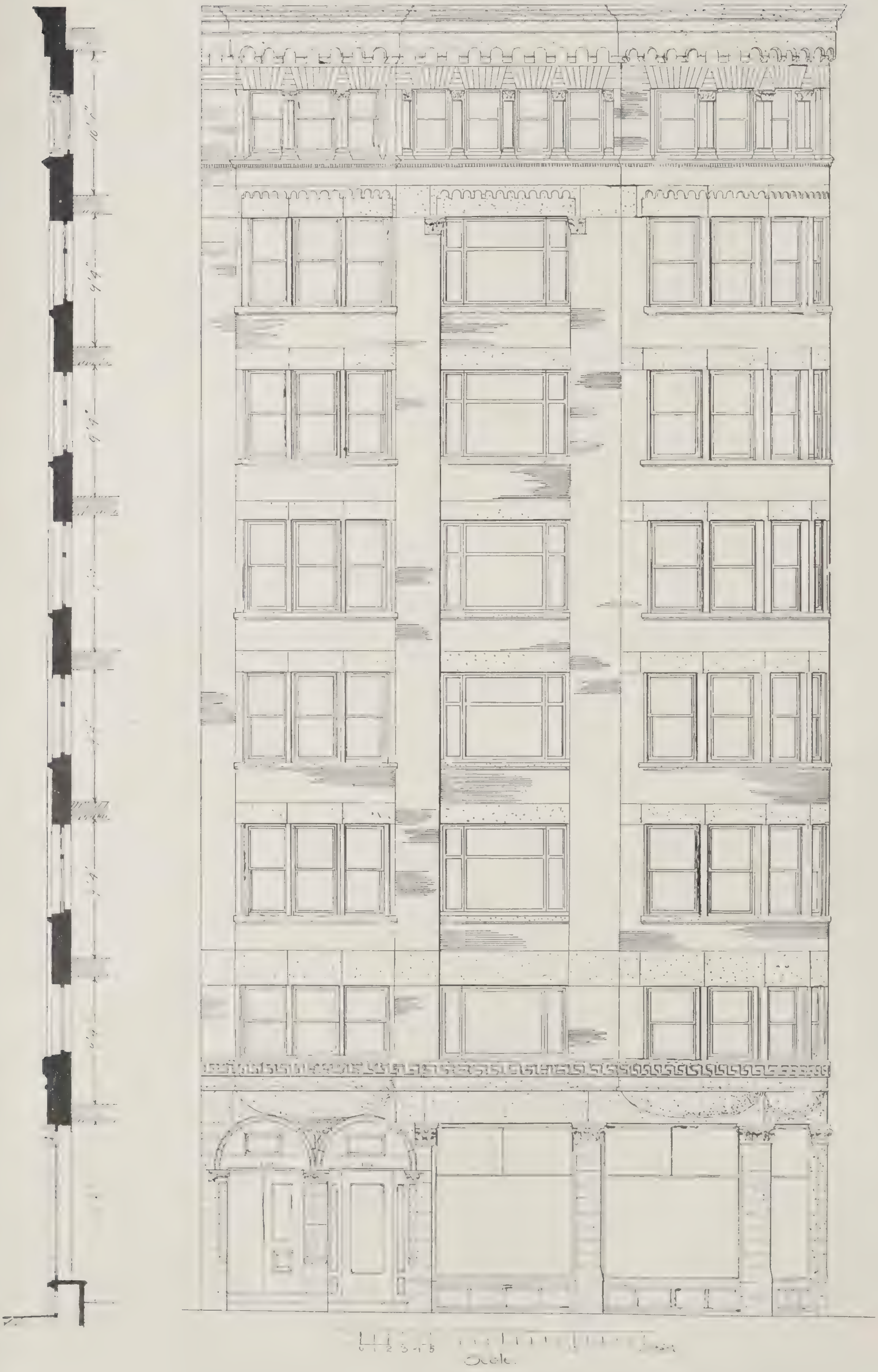
JAMES ANGUS BOYD.

TO such as knew him the death of James Angus Boyd comes in the sense of a deep and personal loss; for by his passing away there has been taken from our midst one whose association has ever been a source of benefit and help. Few, indeed, are there who by the closing of their life inspire the same heartfelt grief and keen sorrow. Not alone among those that kinship or kindred ties had brought in close connection, but extending to a far-reaching circle of acquaintances who were favored by his friendship or honored by his regard. Few, indeed, there are that have the same attributes of character which draw men to them as did he. Noble and kind, ever patient and considerate, always ready with heart and deed to help those less fortunate than himself. Loyal himself, and trusting others, he inspired among all who came within the broad circle of his friendship a deep and lasting regard. And, now that he is no more, he leaves behind the enviable reputation of a life that was not lived in selfish egotism, but, rather, one in which the precepts of noble manhood were everywhere evident, and the memory of which shall always endure.

Mr. Boyd was born in Rochester, N.Y., fifty-nine years ago, and in the early seventies came west to St. Joseph, Mo., where he became connected with brick machinery, as manager of The Kennedy Dry



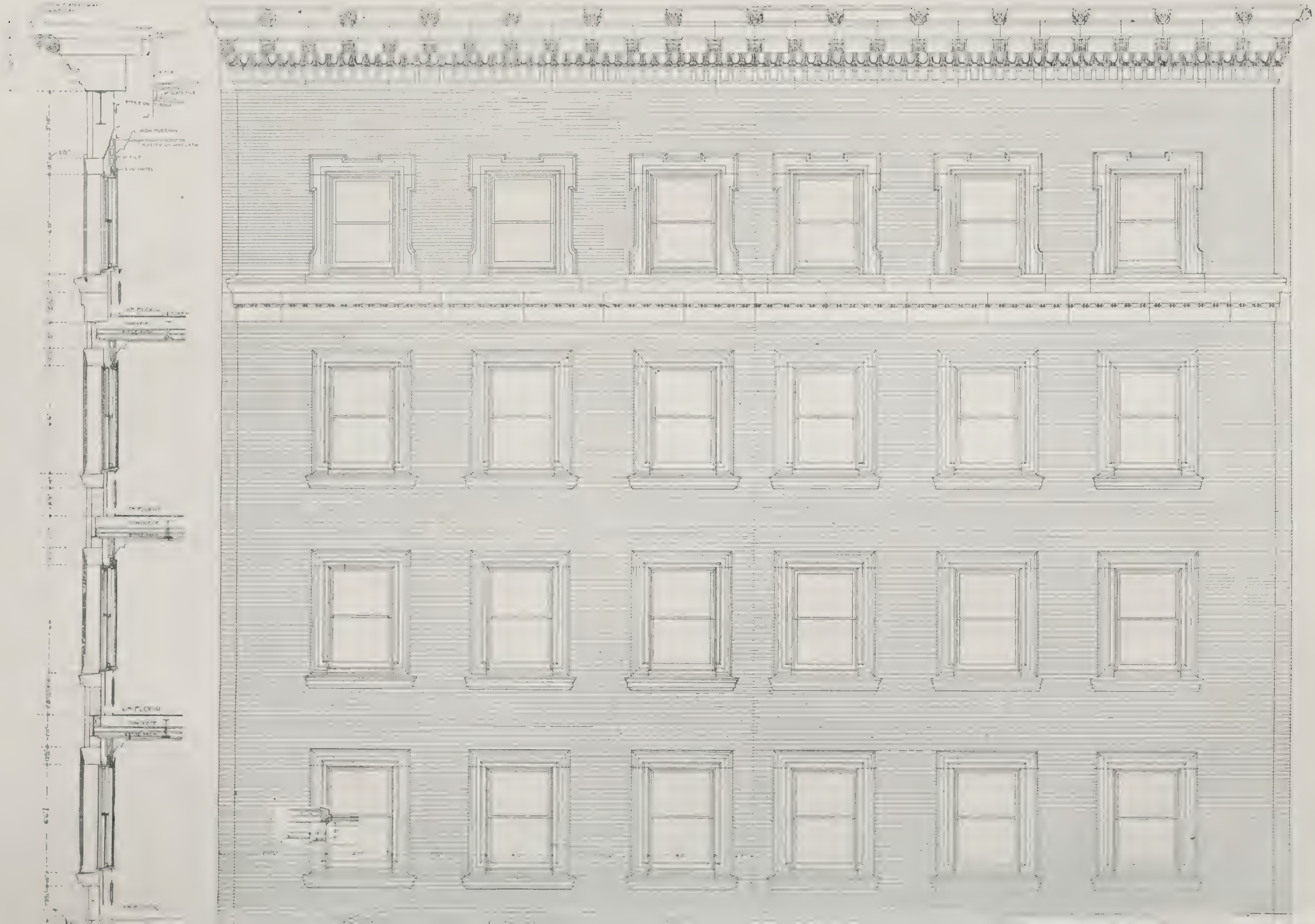
MEASURED DRAWING OF CLOISTER OF SAN FRANCESCO, BRESCIA.



KING BUILDING, MILK AND BROAD STREETS, BOSTON.

WILLIAM WHITNEY LEWIS, ARCHITECT.

VOL. 5. NO. 1.


SLATE TILE
TILE ON T IRONS
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5'-10"
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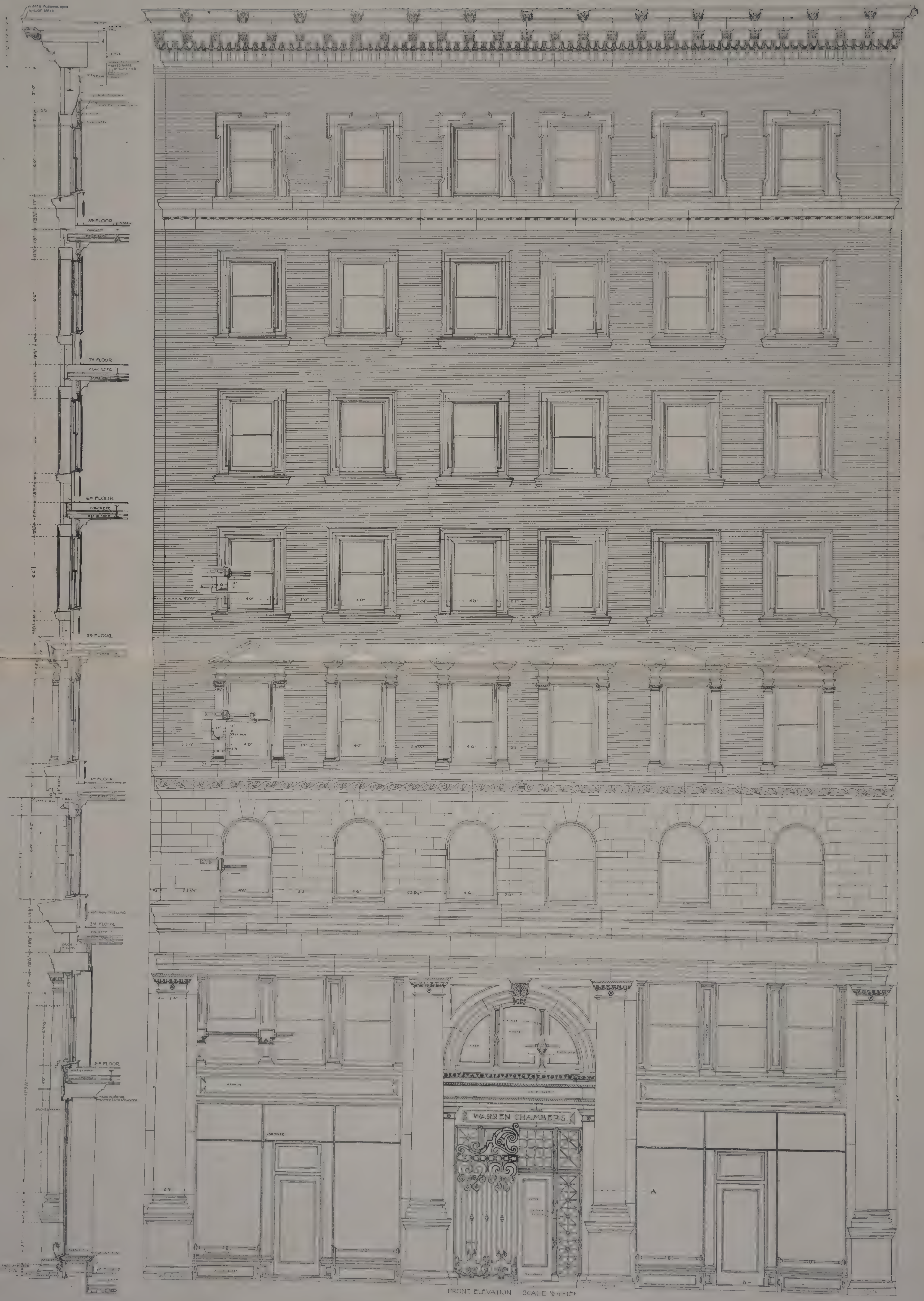
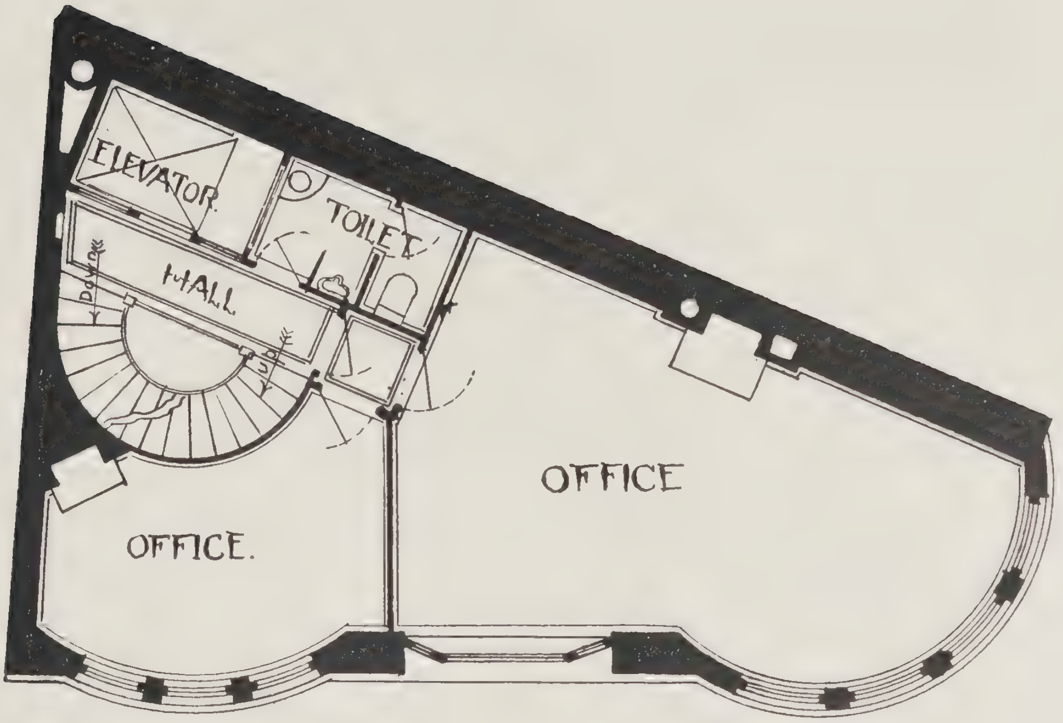
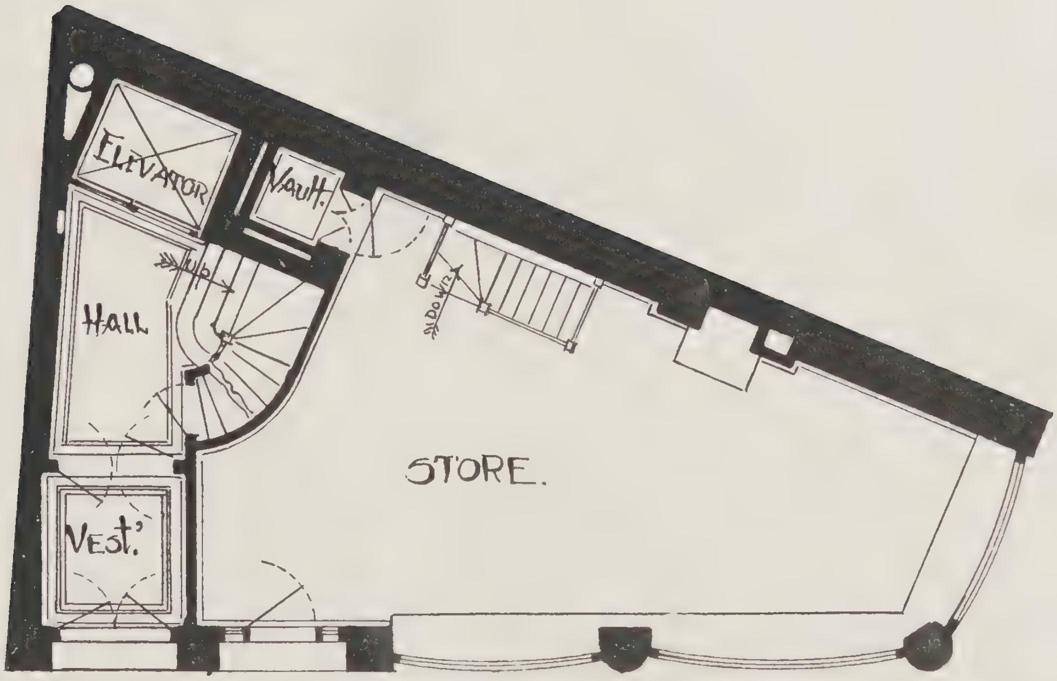


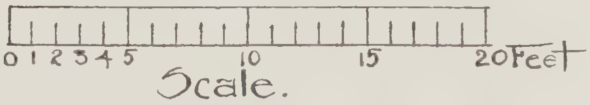
WARREN CHAMBERS, BOYLSTON STREET, BOSTON.
BALL & DABNEY, ARCHITECTS.



Typical Floor Plan.

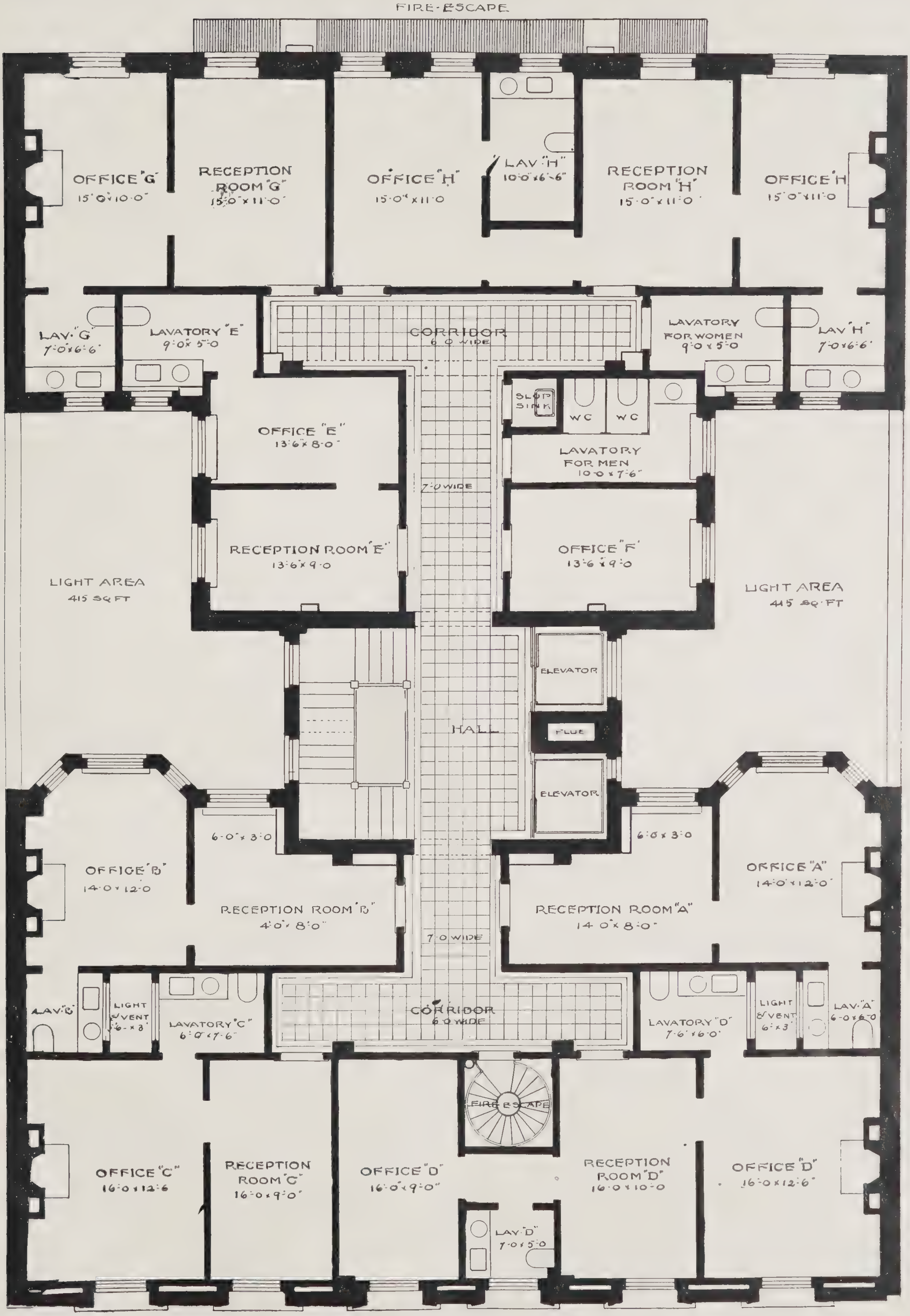


First Floor Plan.



Scale.

KING BUILDING, MILK AND BROAD STREETS, BOSTON.
WILLIAM WHITNEY LEWIS, Architect.



WARREN CHAMBERS, BOYLSTON STREET, BOSTON. Typical Floor Plan.

BALL & DABNEY, Architects.

VOLVME
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1896
No. 2

THE BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

WITH all the improvements which have been made in the mechanical details of the construction of terra-cotta, notwithstanding the ease with which we can secure evenness and uniformity of composition, we have not yet been able to excel, and indeed are hardly able to equal, the artistic qualities of the work which was produced in some of the art periods preceding the present day. Terra-cotta, as a building material, is all that we could wish it if properly manufactured. The tests which it is required to stand in first-class work are that the material shall be so hard it cannot be scratched with the point of a knife nor attacked by acid of a certain strength, and that its strength must be such that it will resist without crushing at least 6,000 lbs. to the square inch. These are very severe requirements, but can easily be lived up to in a mechanical sense. When it comes, however, to the more impalpable and less accurately measurable artistic qualities, there is something about the older work which seems to put it on a different plane from much of the terra-cotta we see in our modern buildings. There is a delicacy, a sense of refinement in detail, and a feeling of fitness in the employment of such work as is found in the Certosa cloisters at Pavia, or the tower of S. M. della Grazie at Milan, which is often conspicuously lacking in modern examples, even when the older forms are faithfully copied. We will not say it is always lacking, for there are some notable examples wherein the terra-cotta has been used in a manner which leaves very little to be desired; but, as a rule, we are inclined to think our designers have not struck quite the right spirit. A suggestion which appeared in a recent instalment of Professor Marquand's paper on the Della Robbia terra-cottas, published in the November number of this magazine, would seem to indicate a possible cause for at least a portion of the lack of fitness of which we complain. In describing the tomb of Bishop Benozzo Federighi, in the church of S. Francesco di Paola, attention is called to the polychromatic glazed terra-cotta frame, which is not painted and baked in large masses with ugly visible joints, but, like glass mosaics, is broken into small irregular pieces uniting to form a complete and solid whole. It is, in fact, a mosaic of glazed terra-cotta units.

If one will examine carefully and understandingly the terra-cotta work at the Certosa at Pavia, considering it simply as an art creation, the last thing that will occur to him will be any consideration of the joints, as such. A moment's reflection tells one that the pieces must be small, and that the joints are there, but they do not obtrude themselves, they are not cut right across a pattern, nor spaced so regularly as to emphasize themselves, but just as in the S. Francesco tomb, the terra-cotta forms a complete and solid whole, and is not an aggregate of small particles. In modern work it is very rarely that the same degree of attention is paid to the jointing. We are too apt to consider terra-cotta as a mere variety of brick, and to feel that somehow or other the joints will not be sufficiently prominent to manifest themselves, — that after the design has been elaborated on paper it can be ruled off arbitrarily into blocks of a convenient size for manufacture and handling without requiring any special consideration of the relation between the joints and the design. In brickwork we pay relatively little attention to the joints, and try to consider the wall surface as a whole, deriving texture from the proportioning and arranging of joints, but not influenced essentially in its character by the joints themselves. In terra-cotta, however, we must consider that we are dealing with mosaic work, and that the joints count for a great deal if they obtrude themselves. This does not mean that the joints must be made necessarily extremely fine, and surely it does not mean that the joints need be concealed or pointed and glazed in conformity with the general surface of the terra-cotta, but it does mean that when we are employing a material which, because of its essential nature, must be handled in blocks of certain or varying sizes, the shapes and the dimensions of these sizes must be considered in working out the design, if we are to produce a result which is coherent and self-contained. We imagine that much of the objection which exists in the minds of some architects against terra-cotta for the finest work has arisen from noting the result of injudicious jointing. Unfortunately, it seems to be assumed that architects do not know how practically to joint their own terra-cotta. The manufacturers apparently prefer to make such arbitrary divisions themselves without special reference to the design, so long as the construction is practical. The procedure ought to be in just the other direction. The architect should consider the terra-cotta as an aggregate of units, and should design his work with reference to joints just as truly as stained glass is designed with reference to the leads, or as block mosaic is designed in reference to the small tesseræ.

We believe the possibilities of terra-cotta are such as to permit of its application to any form or style of building, but terra-cotta must be always terra-cotta if it is to be truly successful. We cannot imitate wood, stone, or iron forms, and hope to get good results. We cannot expect the impossible from even this most varied material.

We are inclined to think that very little modern terra-cotta has been rightly designed in this respect. On the other hand, we believe that if the designers would make it a point to consider terra-cotta as a mosaic on a large scale, would pay more attention to the joints as a function of the design, or would make the design such as would conform to the possibilities of the material, and not expect that all joints be either vertical or horizontal, but rather so plan that the outline of the design and the outlines of the pieces in a measure coincide, there is no reason why the most delicate and graceful conceptions should not be so executed in terra-cotta that the joints, as details of construction, would be as inconspicuous as they are at the Certosa or in the Della Robbia groups, with a resulting effect which would be quite equal to the antique, and far more personal, so to speak, than would be possible with a less plastic medium. Stone is cold and intractable and must be hammered and chipped into life. Terra-cotta retains the very touch, the loving caress of the true artist workman, and only needs the proper assembling and judicious groupings of the constructive unit to make manifest its worth.

PLATE ILLUSTRATIONS.

SAINT LUKE'S HOSPITAL, PLATES 7, 8, 9, 10, 11, 12.

THE new St. Luke's Hospital, when completed, will consist of a group of twelve semi-detached buildings, standing on a high plateau to the northwest of Central Park. The plot is bounded on the east by Morningside Avenue, on the north by 114th Street, on the west by Amsterdam Avenue, and on the south by the Cathedral grounds. It is a superb location for a hospital, being very open and raised high above the general level of the city.

The arrangement of the buildings is an entirely new departure in hospital construction. it is an attempt to secure all the advantages of the pavilion system without the disadvantages of that system. The pavilion system in hospital construction came into vogue shortly after the Crimean War. The usual method is to separate the wards from each other by placing them in pavilions connected by covered ways, and to make them in the form of an oblong rectangle, having windows on each of the long sides, while the dependencies are placed at the two shorter sides; the patients' beds are between the windows (which latter are carried very high), so that the sick have a glare of light directly in their eyes all day long.

The main entrance to the building is in the base of the tower at the back of a courtyard on the south side. Beyond the entrance vestibule is the main hallway, some thirty odd feet wide, from which a broad flight of steps leads to the level of the chapel about 6 ft. up. The chapel is about 30 ft. wide, 70 ft. long, and 36 ft. high; the sides are divided into bays by pilasters, from the caps of which springs an elliptical barrel vault with penetrations. Almost the entire end is occupied by a great window with stone tracery; below it is the reredos of marble, at either side of which is a small arcade which is to be carried all around the sides. Between these columns are marble slabs bearing the names of the benefactors of the institution. The chapel is separated from the hall by a glass screen, so that a glimpse of the interior may be had immediately upon entering the building.

Midway between the chapel and vestibule a corridor extends in a longitudinal direction through the Administration Building, having the staircases at either end, near which other corridors branch off diagonally, leading to the surrounding buildings of the group.

One of the buildings on 114th Street is entirely devoted to the nurses. It has its own separate entrance, and the center is occupied by a glazed court, running through to the roof, having galleries at the floor levels, from which access may be had to the rooms. Each nurse has a separate room about 8 ft. wide by 16 ft. long, with a window to the outer air. At present, only one building for nurses has been erected, that to the west of the chapel; it is proposed to build a corresponding one of the same size to the east.

In the new St. Luke's the long connecting corridor is dispensed with, instead of which there is an open air cut-off between the various ward pavilions and the Administration Building; this open air cut-off is in the form of an arcade the full height of the story, through which runs a passage constructed of copper about 8 ft. high, and having at either side louvres to protect passers in inclement weather. By this arrangement there is no possibility of the circulation of air from one pavilion to another, and as the ward pavilions contain no staircases or shafts of any kind, it is impossible for air to circulate from one ward to another above or below it.

The wards themselves are lighted on three sides, the long side being towards the south; they are sufficiently separated from each other so that no sunlight is cut off, the sun enters by some of the windows in every ward during the entire day.

Each of the great wards is intended for twenty beds, all but four of which are arranged so that the direct light is shielded from the patients' eyes.

The dependencies of the wards occupy the north side of the ward pavilion, separated from the wards by a broad corridor, having windows at either end. The buildings which occupy the north side of the group are for the nurses, doctors, and administration purposes.

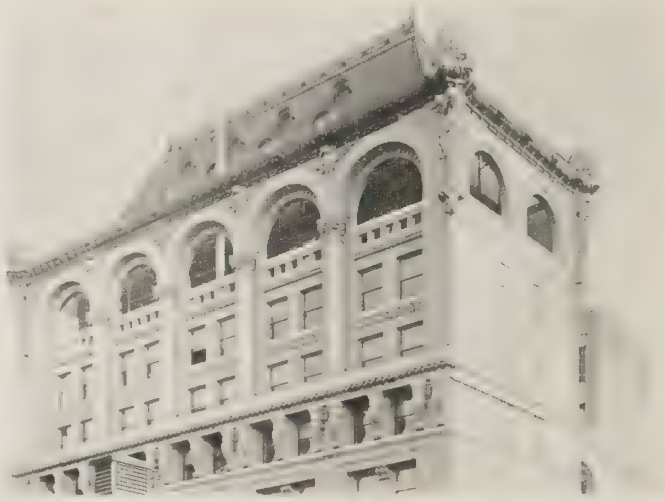
The buildings are of cream-colored brick with marble trimmings, all plain surfaces being of brick, and all molded surfaces of marble.

At the present time one half of the buildings are about completed, the remaining six are to be erected from time to time as the needs of the institution require them, and the funds are forthcoming.

ILLUSTRATED ADVERTISEMENTS.

ON page xxiv will be found the American Tract Society's twenty-one-story building, corner of Nassau and Spruce Streets, New York, reproduced from the architect's pen-and-ink perspective. The first five stories are granite, and the remaining sixteen are terra-cotta of the same sober gray tint, with bricks to match, the latter being relieved by bands of a somewhat lighter shade. As will no doubt be remembered by many of our readers, attention was directed to this building in an article published in THE BRICKBUILDER, for May, 1895, entitled "Terra-cotta or Stone?"

The four allegorical figures by which the angles of the twenty-first story are emphasized measure about 18 ft. in height, and were modeled at the New York Architectural Terra-Cotta Company's Works, by Mr. Miranda. The roof, covered with tiles of a dark chocolate, makes an effective sky line, and considering its great height, the contrast, though bold, is not too strong. When we say that Mr. R. H. Robertson was the architect, it will be readily understood that there is nothing tame or commonplace about the building. The adjoining print is from a photograph of the upper stories, taken from the roof of the Potter Building, 38 Park Row.



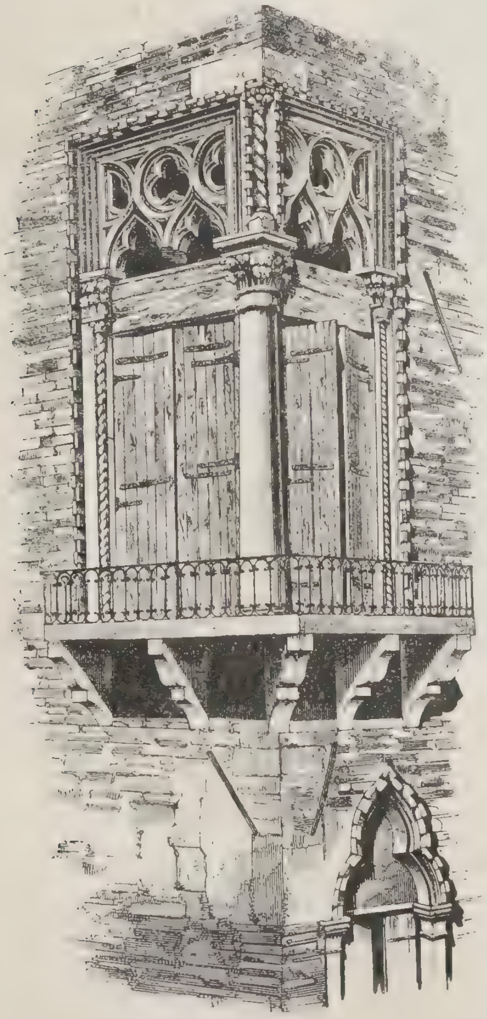
The design shown in the advertisement of this company is by Edwin R. Clark, Lowell, Mass., and is the one that took second prize in the competition which was recently held through the columns of THE BRICKBUILDER.

BRICK AND MARBLE IN THE MIDDLE AGES.

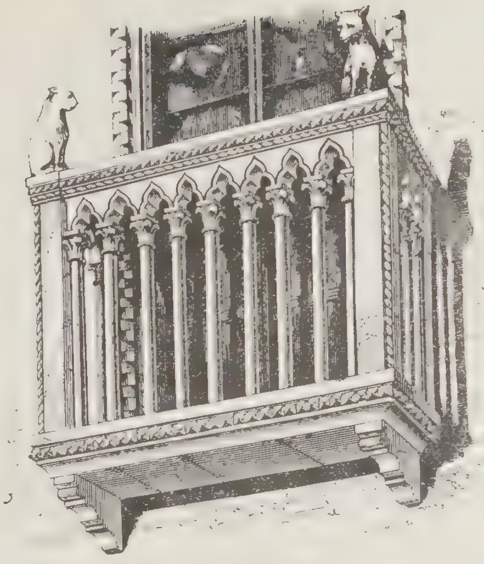
G. Edmund Street.

CHAPTER VIII.— *Continued.*

ANOTHER palace, also said to belong to one of the Badoer family, placed at the junction of two canals very near the Scuola di San Giorgio and the Greek Church, is remarkable as being now one of the very few houses in which the red brick walls are still in their original state, and not defiled by compo, paint, or whitewash. This house has three fronts, with one old doorway on the canal, and two on the land. The back, facing the Campo San Severo, has an unusually fine and lofty entrance, a square doorway with a pointed arch above (which I suppose once held tracery), and a group of five windows with circles or disks of marble in their spandrels above. Amongst other things, it is remarkable as an instance of the way in which windows were sometimes placed absolutely at the very angles of the building. Judging by the similarity of its tracery to that above the Porta della Carta in the Ducal Palace, this angle-window must date from about 1400 to 1430. It has a very bold shaft at the angle, whilst the jambs have pilasters ornamented at their angles by a twisted cord-like molding, which is frequently met with in the later work. There is a small angle-shaft elaborately twisted just above this window, and very much like the angle-shafts of the Ducal Palace.


ANGLE WINDOW, VENICE.

The composition of the main window in the front of this house is, I think, very striking. The lower window of four lights (one of which is larger and loftier than the others — a curious instance of the junction of regularity with irregularity), and whose arches are ogee trefoils, is surmounted by another window of four lights, with delicate balustrading between the shafts; and on each side of this upper window, and forming part of the composition, is a single light, with projecting balcony. The effect of the whole arrangement is pleasing, and is frequently repeated in other palaces. The marble incrustation over this window is very much like that in the other Palazzo Badoer; and from the center of the medallions of marble small balls of marble project, fixed with metal, and giving great life and beauty to the medallions, and I think without any sacrifice of truth. The main fabric of this building must be of the latter part of the fourteenth century — the arches of the principal window being of a very excellent though simple type. Venetian balconies, of which this palace affords such good examples, are very beautiful and very characteristic. Nowhere else are they seen in such perfection; nowhere else, perhaps, were they ever so absolutely necessary. The palaces rose out of the dark water which washed against their foundations, and no ground could be given up for shady arcades as in other Italian cities, nor were there any paths to be strolled along; the only resource was, therefore, to gain from the air that which the land could not afford, and by projections in front of the windows, to obtain that power of enjoying the delicious evening atmosphere, so cool and pleasant after the fatigues of the too sultry day. These balconies are almost always very similar, consisting of a number of delicate shafts with carved capitals, supporting a piece of stone whose under side is notched up in a series of trefoils (generally ogee), resting upon the capitals of the shafts. These are divided occasionally by pilasters, under which are corbels jutting out boldly to support their weight; and above which sit, generally, quietly, and placidly eyeing the gondolas as they shoot silently by, small lions, dogs, or other animals — a quaint finish which one soon learns to like; their angles are often marked by corded moldings, and the edges of their floors and copings are almost always molded and specked with the perpetual notchings of the nail-head, and their under sides or soffeits are frequently carved or paneled.


BALCONY, VENICE.

There was great variety in the planning of these balconies. In the Palazzo Persico, for instance, in which the central windows of the second and third stages form one great panel, the lower balcony is continuous across all four lights of the window, whilst the outer lights only of the upper window have balconies, the two middle lights having instead a balustrade between their shafts. In other cases the balconies extend to four lights only of a six-light window, whilst in most they are confined to the central windows, to which they give much additional dignity. The Ca' Fasan affords an almost solitary example[1] of tracery in a balcony; and the effect of this is so vastly inferior to the usual shafted balconies, that it seems scarcely necessary to pause to consider why it should be so. Obviously, however, it is not very convenient to have the fretful points of cusps and traceries set, as it were, to catch every projection or point of your dress whenever you lean over the edge of the balcony to inhale the fresh air or scan the busy scene below.

In the Casa Persico, to which reference has already been made, the central window is an elaborate composition of the same kind, but the lower one is of more importance, and has a continuous balcony;

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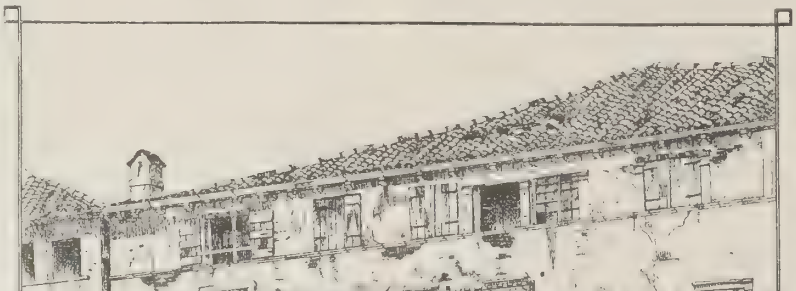
[1] There is another traceried balcony in the canal near the Bridge of Sighs. It is the only other example I know in Venice.

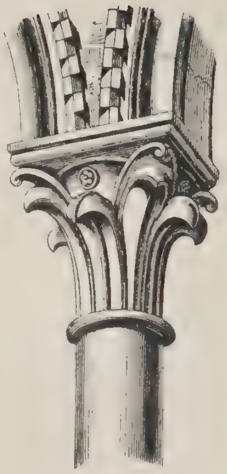
and here I may notice the finials with which the ogee arches of Venetian windows are so often finished. They appeared to me to be invariably tasteless and poor in execution, and very mean in their outline. I did not see one finial in Venice which was satisfying, even when found in conjunction with otherwise fine work, and I used to wish heartily, when I reached some palace not before seen, that I might find its arches finished without them. There was some reason for the wish, too, in the fact that it is in the latter work that these tasteless ornaments are commonest. I saw them first at Verona and lamented over them there, but at Venice I was positively annoyed by the persevering and endless thrusting of their poverty and badness upon my wearied eyes.

And now let us go again into the Grand Canal, and we shall not have gone very far up the broad water above the Rialto before we shall find, on our right hand, one of the most striking groups of medieval palaces and houses which can be seen anywhere, even in Venice; this is where the famous Ca' d'Oro unites with some three or four other houses, of rather earlier date, and gives a very fair idea of what the water scenery of the ancient city once was. There is some difficulty in criticizing the Ca' d'Oro, because, in the first place, it has been restored to render it fit for the occupation of Mdlle. Taglioni; and, in the next place, much of the elaborate decoration from which it derived its name has perished or been destroyed. As it is, however, it is still a very sumptuous example of the later fourteenth-century Gothic. Its whole face is inlaid with squares of red and white marble, and a great amount of carving is spread over the entire surface, round and between the windows. This is very flat, but good in its effect. The arcade on the water story, and the traceried arcades above, all open into recessed courts,—an arrangement peculiar, I think, among Gothic houses, and similar in its purpose to the arcades in the Byzantine palaces. Some of the balconies are good, and the carving of the capitals and molding of the window traceries are very characteristic of Venetian pointed. The whole design is one-sided, and gives the impression of a house to which an additional wing has been added. The water stage consists of an open arcade of five arches, the central arch round, the remainder pointed, and on one side of these are two windows with a continuous balcony. The second and third stages have, above the five open arches, elaborately traceried windows, of no less than eight lights in width, filling almost the entire front, the outside lights having balconies, whilst the others have balustrading. Over the two windows of the water stage are single-light windows in each stage. There are throughout this front many medallions of dark marble, which, let into a field of light marble, are most brilliant in their effect.



PALAZZO SEGREDO, VENICE.

The most remarkable features in the Ca' d'Oro are, however, the triple and elaborately carved and chevroned angle-shafts which I have nowhere else seen,[1] and the very singular parapet. The height of this is greater about the center and at the two ends than elsewhere: but this appears to have been done rather with the intention of carrying up to the very top the noticeable division in the building itself than for any other reason. A very small portion only of the parapet is perfect, and this it is rather difficult to get at. The small balls of marble affixed to the outer edge of the trefoils are like those in the tracery of the Ducal Palace, and in the center of the medallions of marble everywhere throughout the city. Their effect is certainly very piquant.



CAPITAL OF WINDOW-SHAFT, VENICE.

By the side of the Ca' d'Oro there are three ancient houses of considerable interest, and the second from the Ca' d'Oro, the Palazzo Segredo, was a very good example, indeed; it has, unhappily, I believe, all been restored and painted, so that now few would believe that it could ever have been (as it was) one of the very best works in Venice of its age. It quite deserves illustration on account of the extreme vigor and beauty of its great window, which has more of the flavor of the arcade in the Doge's Palace than anything else in Venice. These three houses are all more than usually irregular in the arrangement of their windows.

Lower down the Grand Canal, and nearly opposite the post-office, is the Palazzo Pisani-Moretta, a very late building, in which all the balconies are Renaissance, with ordinary balustrading; but this occurs so often in connection with the latest examples of Gothic work, that I am disposed to believe that they were possibly, after all, contemporary in their erection. This palace, too, is remarkable for its double entrance doors, with ogee arches, and for the manner in which the central window is carried up in an uninterrupted way to the very cornice; the lower traceries being very fair, those in the upper story very weak and bad.

The Palazzo Falcanon (alla Riva Tonda) is another fine house. It has two water gates, is four stories in height, the third being the principal floor. The angle-shafts are all spiral, and the string-courses all ornamented with cable moldings, which, as is usual, are twisted in reverse ways from the center of the front.

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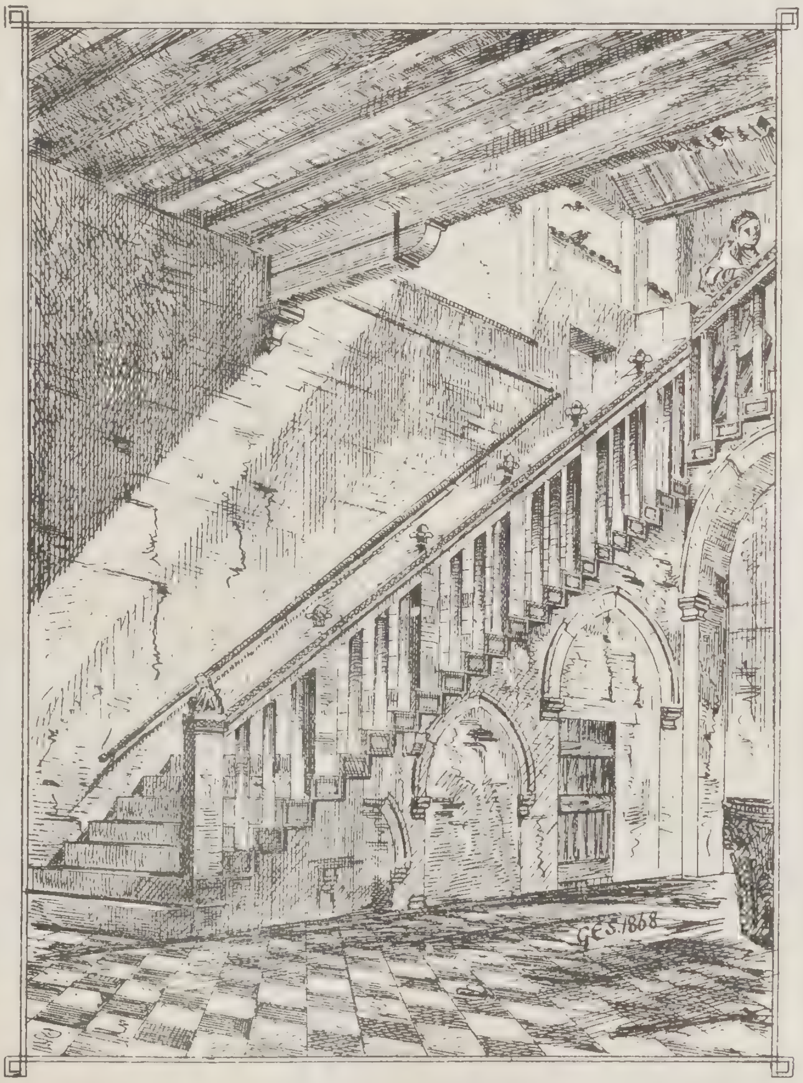
[1] They may be compared with the chevroned and spiral columns in the archway leading from the north aisle into the baptistery of the Frari, erected between 1361 and 1396, which is probably about the date of the Ca' d'Oro.

The Palazzo Celsi, near the Frari, is, like the Badoer Palace, an example of a fine regularly designed house with its brickwork left in its natural state; and the Palazzo Orfei is an instance of the finest (and a very fine) front being turned towards a *campo* and not towards a canal. The long group of medieval houses, which formed one side of the Campo Sta. Maria Formosa, was equally worthy of admiration, but has lately been modernized, — a fate which is only too rapidly overtaking most of what one used to admire in this once fortunately neglected city!

The window of which I give an illustration, on the Ponte del Fornaro, is a rare but extremely good example of the combination of sculpture and tracery. Here the carvings are good examples of the emblems of the four Evangelists very ingeniously treated, and the whole window has more force than most of the traceried windows.

With notices of two more buildings, the Palazzi Cavalli and Barbaro, I shall conclude my remarks upon the existing examples of Venetian domestic work. Neither of them calls for much remark. The traceries of the Cavalli Palace are heavy and unsatisfactory, and contrast unfavorably with the greater simplicity of the windows in the Palazzo Barbaro. The two palaces stand, however, in a very fine position on the Grand Canal, commanding the view from the Foscari Palace in one direction to the church of the Salute and the mouth of the canal in the other. Nearly opposite them is a very striking house, the Ca' Dario, built, I imagine, about the commencement of the sixteenth century, before the revived classic feeling had fully possessed the Venetians, and displaying some effective and beautiful arrangements of constructional decoration with colored marbles. It is, in fact, an attempt to revive, to some extent, the art of incrustation, as practised at S. Mark's, and so successful is it, that I wonder much that more examples are not met with.



CASA GOLDONI, VENICE.

In the Grand Canal, and near this spot, are many other buildings, all worthy of illustration, but adding, I think, nothing to what we already know. The Ca' Fasan is the most unlike the other medieval houses of any; but it pleased me so little that I could not bring myself to waste time by sketching it. It is only fair to say that in its traceried balconies it approaches more nearly to the latest northern pointed than any other building in Venice, and that it has perhaps at the same time less breadth and dignity than any.

Two fine palaces[1] are now turned into hotels, and that at which I stopped was full of remains of pointed windows; indeed, traces of pointed work are singularly plentiful, and I might go on to an interminable length were I to attempt to describe them all. The Arsenal is old, I believe, but has been modernized. It may be visited now for the sake of the grand and quaint old lions which sit before its entrance.

Of the interiors of these houses I cannot say very much. They usually have a great hall in the center of each floor, into which the various rooms open; and the windows of these halls are generally the most important in the elevation. The frames of the windows were of wood, placed behind the traceries, and the original ceilings were the molded beams of the floors. I have only seen one good Gothic staircase in Venice. This is in the Casa Goldoni, and has for its balustrade a series of shafts with piers at intervals. Its detail, in short, is that of the balcony, but sloped up to suit the rise of the steps. Pointed arches of brick carry the steps. This house may well be visited by other than architectural pilgrims, and will be found near the Ponte San Tomà. A fine early Renaissance staircase remains in the Palazzo Minelli, near San Paterniano. This is circular, with continuous open arcades following the rise of the steps, the usual shafted balustrade filling the lower part of the openings between the columns. The chimneys of these palaces are very singular. Not many old examples remain, but they are still copied, and that some of them are really old is proved by the extent to which they are shown in early Venetian paintings, as, *e. g.*, in the works of Gentile Bellini and Carpaccio. In my illustration the examples Figs. 2 and 3 are copied from paintings, and Fig. 1 is from a palace near the Ponte Bernardo.

And now that we have so far passed in review a series of the finest remains of medieval architecture in Venice, it is time to inquire how much is to be learned by what we have seen, and in what degree it differs from the developments of pointed architecture with which we are familiar in Northern Europe.

I think the very first point to be observed is, that in Venice architecture was never essentially constructional in the sense in which it was in our own land. The pointed arch is rarely used except in churches, and in its place traceries, increased in size and scale to do their work, are made to carry the entire weight of walling above them, as is the case, to take the foremost example, in the second stage of the Ducal Palace. And it is remarkable that when the arch was used, from a very early date it was the ogee arch, and not the arch formed by two simple curves; indeed it may almost be said that the pure pointed arch was never used, save where it would have been quite impossible with any other contrivance to bridge the necessary gap, or provide sufficiently for the weight to be supported. How striking a contrast this is to the way in which in England men worked with and exhibited the pointed arch, evidently as if and because they loved it! — using it not only as a sturdy servant to do heavy work, but as the friend of whose friendship they were ever the most anxious to boast. I do not complain of the flatness and lack of breaks or recesses in the masses of the great Venetian buildings, because this no doubt arose in part from the value of every foot of ground so hardly gathered from the sea, and the difficulty of throwing out buttresses into the narrow depths of the canals out of which they rise. And the same conditions which enforced this flatness are grateful because they involved the charming balconies which are so peculiarly Venetian, and gave a breadth and simplicity to the outline which has its own artistic charm.

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[1] The Europa Danieli's.

In the science of molding I cannot but think that it is quite useless to compare works executed for the sunny skies of Venice with those fitted for the gloomy sunlessness of a northern climate. The one kind are as properly soft, gentle in their alternations of light and shade, and delicate as the other are piquant and sharp, rejoicing in the dark shade of deep hollows and endless intricacy of outline and arrangement. But I feel no doubt whatever that, unfair as it may be to compare one school with the other, seeing that each worked for its own wants, it is yet most clear that the northern architects were developing a much deeper art, and working with much more consummate skill than were the Venetian. The endless variety of the arrangement of capitals, and the necessary grouping of moldings to fit their varying outlines, was carried to the extreme point of perfection by the one school, whilst in the other, not only was there much less depth and relief, but also very much less variety. The abacus of the Italian capital was almost always square in plan, and, as an almost necessary consequence of this, moldings retained very much the same arrangement and shape for the whole period of the prevalence of the pointed style, and generally rather leaned to the side of heaviness than of delicacy. Venetian moldings are composed of the constant combination of a three-quarter bead and a shallow hollow divided by small fillets, and so invariably arranged in almost exactly the same order, that it requires very great care to decide upon the date of buildings by their moldings with any sort of approach to certainty.

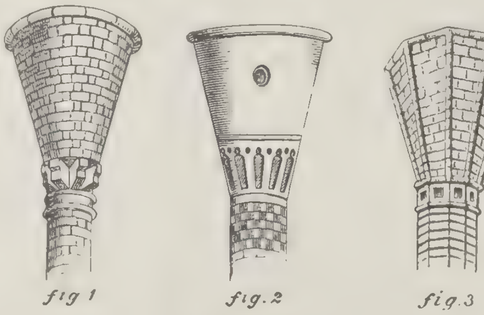
fig 1 *fig. 2* *fig. 3*

CHIMNEYS, VENICE.

In addition to simple moldings, there are also the ever-recurring ornamented moldings which are so peculiarly characteristic of Venetian works of all dates. These consist generally of sections which in England we should consider Romanesque, but which in Venice appear to be much more common in the latest works than in the earliest. Chevrons, cable-moldings, billets, and the like are seen everywhere, and suggest the question whether this class of ornamented moldings, so largely used in the early days of architecture in England and so little afterwards, might not with some advantage be rescued from the contempt into which it has fallen with modern builders. They have the advantage of being within the power of any ordinary workman to execute, and do not, therefore, require the handiwork, which is so rare and so precious, of thoroughly good carvers. Add to this that some features, originally invented for use in the way of holding together marble incrustations, were afterwards used universally for their own sakes as ornamental moldings, for which office they were in no way fitted, and I think nearly as much has been said as can be of Venetian moldings in stone. Those in brick are even less satisfactory, but they occur mainly about the churches, and, as I do not recognize anything at all distinctively Venetian in their design or arrangement, it will be better to say more about them after we have seen the brickwork in other cities in the north of Italy, compared with which that at Venice is not of the first order.

In the practise of carving, as in that of molding, I see no reason for yielding the palm to the Venetian. It is true, indeed, that the Byzantine capitals — of which such magnificent examples exist at S. Mark's are some of the most exquisite I have ever seen, true and precise in their sculpture, reveling in the utmost delicacy of intricate work, and always refined and elaborated with great evidence of care and thoughtfulness; but after the earliest school, and those later examples in which they were copied and regarded as models, there appears to me to be much less to admire. There is a confusion and want of fixed purpose about many of those which are commonly referred to as the best types of Gothic sculpture, which is at best not satisfactory, and I confess that I came away much more pleased with some of the Byzantine capitals than with any others. They have some notable points of difference from those to which we are used. They are generally much larger in proportion to the shaft than ours; and instead of having a regular neck-molding, they rise out of the shaft with a kind of swell, which, as being less definite, is to me less satisfactory than our neck-molding. The capitals of all dates are very generally similar in their outlines; this in part arising from the constant occurrence of circular columns with capitals, whose abaci are square, and in part from the imitation, more or less closely, of Byzantine models. Indeed, it is impossible not to see how great an influence the earliest remaining work — that of the eleventh century — had in Venice until the end of the fourteenth and far into the fifteenth century. The most beautiful and striking arrangements of the former age are reproduced and only slightly modified in the finest work of the latter to a very remarkable extent, and so much more decidedly and frequently than are the traces, in northern pointed, of any hankering after the features of Romanesque buildings, that I think but one conclusion can fairly be drawn from the sculpture of Venice as well as from its architecture, viz., that pointed architecture was never developed as purely and thoroughly in Venice as in the north of Europe, and that, though it retained its sway there nearly as long as it did elsewhere, it never thoroughly understood or felt its own strength, and worked and toiled tied down and encumbered by Byzantine fetters and classic sympathies. There is much, notwithstanding this, to admire, and, above all else, the greatest beauty of the style, wherein it so far left us behind, the thorough appreciation and unsparing use of the shaft. It is quite astonishing how very little this was ever used in England. Occasionally, indeed, it was freely used in grand buildings, and in some individual features it was frequently seen in thirteenth-century buildings; but, at the very period when, if ever, architecture was in its perfection — in the early part of the fourteenth century — it was almost entirely forgotten and thrown aside. All honor, therefore, to the men who so perseveringly and determinedly used it as did the builders at Venice for three centuries! And all shame to us if we do not attempt for the future so far at any rate as to follow in their steps! So rare are any but shafted windows in Venice, that at present I hardly remember a single instance of a window with monials formed by the continuous moldings of the tracery; and it is obvious that this gave occasion, not only to the use of beautiful marbles — never so well used as in shafts — but also to the constant use of carved capitals. In domestic buildings, as I have before remarked, this arrangement of shafted windows is very valuable, because it suggests one obvious way in which we may unite traceried windows with the very newest arrangement of window frames or sashes in the most comfortable nineteenth-century houses; for in these Venetian palaces the glass was always contained in a separate wooden frame set within the marble shafts and tracery.[1]

(*To be continued.*)

PERSONAL.

Messrs. A. M. F. Colton & Son, architects, have removed to Suite 802, Reaper Block, Chicago.

Messrs. Parker & Austin have removed to Hobbs Building South Michigan Street, South Bend, Ind.

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[1] This arrangement is not by any means unknown in Northern Europe, though certainly uncommon as compared with Italy, where it was almost universal. There is an example of the thirteenth century at Easby Abbey, Yorkshire, and another at Oakham Castle, whilst in France the ancient houses at Cluny all have it; and at Ratisbon, one of the most interesting cities in Germany, a great number of houses of the twelfth and thirteenth centuries, prodigious architectural interest, have it.

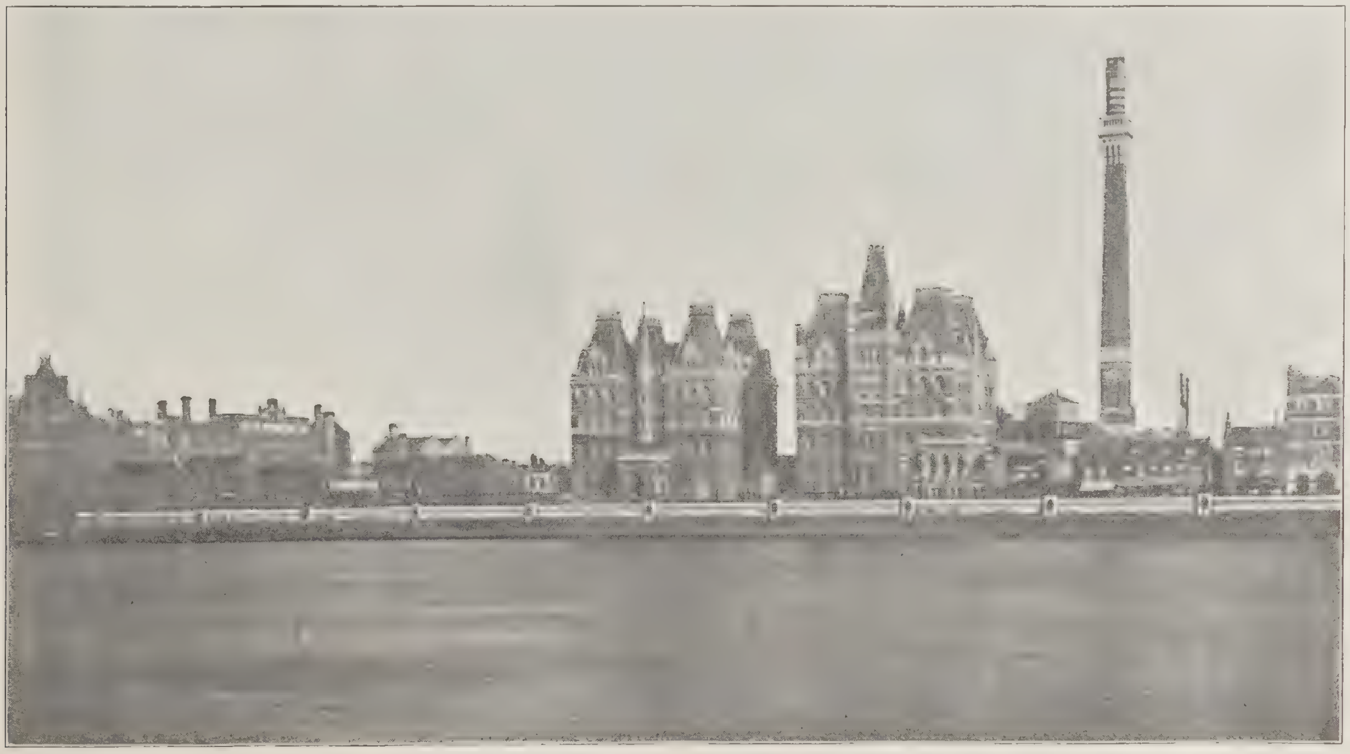
ARCHITECTURAL TERRA-COTTA.

BY THOMAS CUSACK.

(Continued.)

WE are indebted to the courtesy of Doulton & Co. for an excellent photograph of their headquarters at Lambeth, the central feature of which we are thereby enabled to illustrate. The firm has important branches in various parts of England; one in Scotland, another in France, employs a total of about four thousand heads, with presumably twice that number of busy hands, engaged in manufactures of clay.

The point from which this view seems to have been taken is not far from the spot chosen by Turner for the subject of his first exhibit at the Royal Academy in 1790, followed a few years later by another from the same neighborhood, entitled "Moonlight, a Study at Millbank." In both of these, needless to add, the present buildings are conspicuous only by their absence; so also is the massive stone wall forming part of the Albert Embankment. In the foreground, however, Father Thames flows on, eastward to the sea, less limpid, we fear, than when the Romans encamped upon its banks, but venerable withal in the eyes of English-speaking people. Since that time it has been a silent witness, often, indeed, an active participant, in the early struggles, the wondrous growth, and the globe-encircling enterprises of the Anglo-Saxon race. American Line passengers, on their way to London via Southwestern Railway, will obtain another and more comprehensive view of these brick and terra-cotta buildings. They lie between the railroad and the river, and will be seen to advantage just as the train slows down before entering the terminus at Waterloo station.



HEADQUARTERS OF DOULTON & CO., LAMBETH, ENGLAND.

We are fortunately able to give another of Mr. Tinworth's conceptions, of an altogether different type. In it he has told the story of Cleobis and Biton in a severely classical bas-relief, treating it in a becomingly chaste and impressive manner. The sacred oxen not being available, the pious sons of Cydippe, the Priestess of Juno, yoked themselves to her car, and are represented as falling in exhaustion or death, on the steps of the temple, during their mother's prayer, rendered in a poetical version by Mr. Edmund W. Gosse: —

"Hear me, and grant for these, my pious sons,
Who saw my tears, and wound their tender arms
Around me, and kiss'd me calm, and since no steer
Stay'd in the byre, dragg'd out the chariot old,
And wore themselves the galling yoke and brought
Their mother to the feast of her desire;
Grant them, O Hera, thy best gift of gifts."

Mr. John Bell's famous group America, one of the four pieces of colossal statuary flanking the base of the Albert Memorial, Hyde Park, was reproduced in terra-cotta by Doulton & Co. for the Centennial Exhibition. It is now in the Smithsonian Institute, Washington, where we remember having seen a pulpit and staircase, also executed by this firm, and deemed worthy of a place in our national collection.

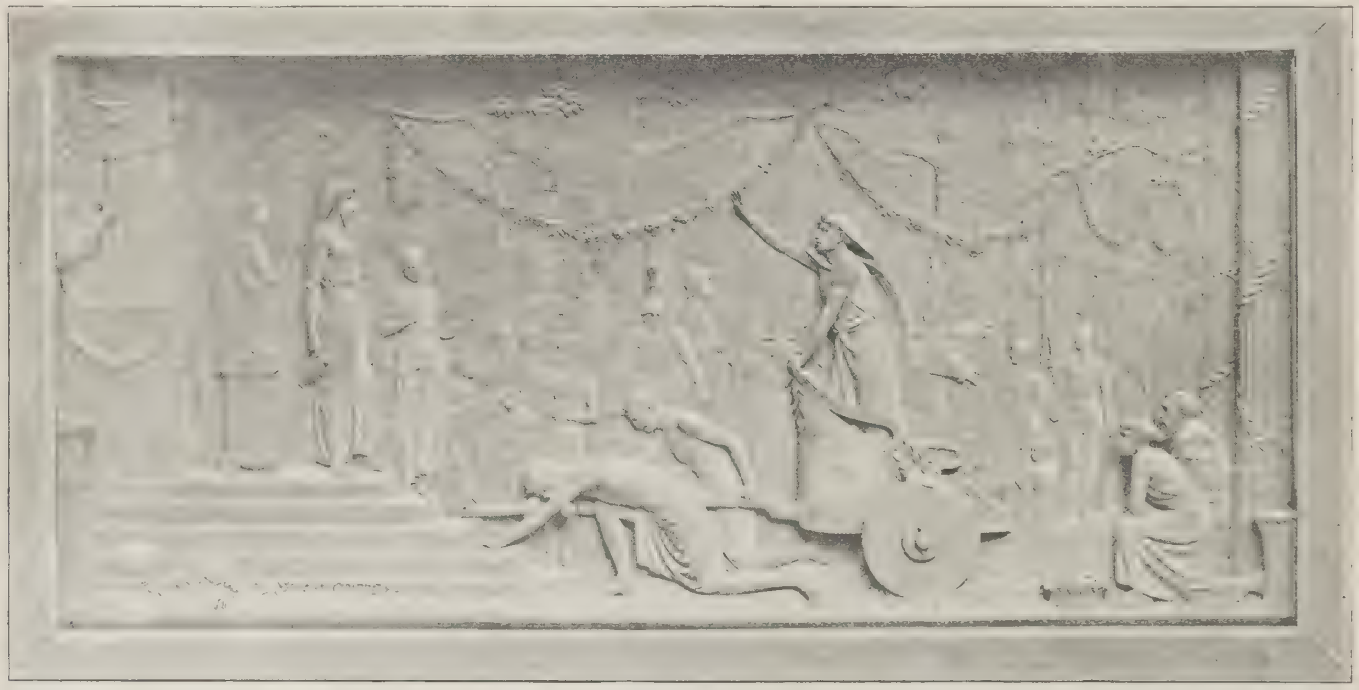
There is a statue of Sir Richard Crosby standing in a niche in Crosby Hall, Bishopgate Street, London. Of the countless number to whom it has been a familiar object, few are aware that it is terra-cotta, and fewer still that it was made in the early days of the Lambeth potteries. It has stood there unscathed for more than sixty years, impervious alike to frost, rain, sunshine, smoke, and yellow fogs. The same may be said of the colossal figure of Britannia on the Liverpool Exchange, executed early in the present century by Coade & Co., Pedlar's Acre, Lambeth. From this same works came the frieze of the Italian Opera House, London, and the well-known panels in Merrion Square, Dublin, dated 1788. The latter have put to shame the surrounding moldings, though in granite from the Wicklow Mountains. A similar comparison will be forced upon any one who has seen the terra-cotta vases in front of Buckingham Palace. They were made by Blashfield more than forty years ago, and are still perfect, while the Yorkshire stone coping on which they stand had long ago begun to crumble.

In marked contrast to these examples of terra-cotta, is the behavior of the crystalline magnesian limestone of which the Houses of Parliament are built. Sir Charles Barry's otherwise magnificent structure is not quite fifty years old, yet for more than twenty the exterior has been undergoing repairs. A special appropriation of $350,000 was afterwards set apart, producing a yearly income of $12,500, which hardly suffices to pay for a renewal of the stonework.

This stone was selected on the recommendation of a royal commission, after an exhaustive scientific inquiry into the product of every quarry in England. Yet the sulphurous vapors of the great city had attacked the beautifully carved crockets and spirelets, etc., before the whole of the scaffolding had been removed. The stone and marble that lasted for centuries in Greece, and under Italian skies, will not stand as many decades in the damp and fitful atmosphere of the British Isles, or the still more rigorous climatic alternations of America. Whether we take the obelisk on the Thames or the one in Central Park, New York, though both of Nubian granite, the effect is the same. Notwithstanding the various "preservative" solutions that were applied, they have suffered more during the past twenty years than they had done in the previous twenty centuries of their existence in Egypt. From present indications, it will not be long before the hieroglyphics of Thothmes III. will have wholly disappeared from the sides of the last-named obelisk, while the imperishable tablets in burned clay, some of which may be seen in the adjacent museum of art, will remain the only written record of the Pharoahs.

The decay of stone has become rapid and general in modern times, and is every day more noticeable in or near the great cities. This is owing, in part, to the vast consumption of coal, and the imperfect combustion of its gases, to which may be added the enormously increased production of corrosive chemicals, and the extent to which they now enter into the arts and industries of all manufacturing centers. Failing to find an antidote for these volatile but destructive acids, architects began looking for a feasible substitute to use instead of stone. They found that nature had already provided the raw material from which one could be made, though, oddly enough, most of it lay in close proximity to the coal itself. The deposits of fireclay found in hard nodules, and sometimes in the formation of shale in the coal measures of Lancashire and Yorkshire, had been used, when it was used at all, for furnace lining and coke ovens, previous to 1842. About that time, Mr. Edmund Sharpe, an architect of eminent attainments in his day, acting upon the suggestion of a colliery proprietor, undertook to use some of this waste product of the mine in the erection of a church at Lever Bridge, near the cotton-spinning town of Bolton.

It was a bold and hazardous undertaking, and must have ended in disaster had it not been pursued with a resolute perseverance worthy of Palissy, and directed by the practical mind of a man who was an architect, in a sense that we fear has been too often "more honored in the breach than in the observance." Of trained help he had none; for until then there had been no demand for such services, and, therefore, no supply had been called into existence to meet it. Brickmakers on the one hand, potters on the other, with now and then a man possessing useful knowledge gained in a mason's yard, was about all he had from which to make a selection. Like the currier in the fable who maintained that in fortifying the town there was "nothing like leather," the mason had a natural bias in favor of stone, which rendered him less useful than he otherwise would have been. Model and mold makers were drawn from the ranks of house plasterers, who, of all the trades connected with building, are, perhaps, the most deficient in a knowledge of geometrical principles, and whose original stock in trade, in so far as terra-cotta making is concerned, was doubtlessly summed up in their ability to gauge a bowl of plaster. The pressers and finishers of those days must have been equally crude and inept in their initial attempts to turn out constructive forms with any approach to mechanical fitness. In the modeling of architectural ornament he was also placed at a disadvantage, which we (with an increasing supply of men from the art schools of all Europe) hardly know how to appreciate. The spirit of the master masons and carvers to whom we owe the English abbeys and cathedrals, from Salisbury, York, and Lincoln, onward to the chapel of Henry VII., has rarely been equaled, and never excelled, in any country, but it, alas, had long since died out. Architecture as an art had not arisen from the depths to which it had sunk under the Georges. The men of the Victorian era, who, as carvers in wood and stone, have done some creditable work that goes far to redeem their age and nation from the charge of being art-less, had not yet made much headway. Really capable men of that class had turned their faces towards the metropolis, with its wider opportunities and more tempting rewards. Certainly few of them were available fifty-four years ago in the manufacturing districts of Lancashire. Finally, he had kilns to build in which to burn his first experimental blocks before he could even guess where he stood for shrinkage, to say nothing of the judgment necessary to turn out successive burnings with anything like uniformity in size and color.


"CLEOBIS AND BITON," BY TINWORTH. BAS-RELIEF EXECUTED IN TERRA-COTTA BY DOULTON & CO.

Mr. Sharpe was a thoroughly equipped architect, however, and in the course of his professional studies had become acquainted with the medieval terra-cotta of Italy; but beyond the medallions, vases, busts, and statuettes, such as have been cited, he had no native architectural precedents, and no examples for its use on anything like so large a scale as he proposed to employ it. But this was about the beginning of the modern Gothic revival, and being a man of independent thought, he saw no adequate reason that could be urged against the concurrent revival of a building material equally orthodox, and of much greater antiquity. In practise he found it capable of meeting every requirement of sound construction, and at the same time susceptible to the most delicate touch of an artist familiar with Gothic forms and foliage, whether he took for his prototype examples from the beginning of the thirteenth or the end of the sixteenth centuries.

What a satisfaction it must have been to the architect to know that the final result of the whole undertaking was crowned with success, notwithstanding the many difficulties that had to be faced and overcome. It will be conceded that Mr. Sharpe was a pioneer in what must have appeared a discouraging enterprise, at a time when the making of terra-cotta was something of a *terra-incognita*. Not only did he establish a new industry, which has taken root in, and has followed the flag of his country, but one that has spread with even greater rapidity in America from Atlantic to Pacific, to the displacement of frames and shingles, and the substitution of fire-resisting structures, with embellishments undreamt of fifty years ago, Whether taken by itself, or in conjunction with iron and steel, it may be said without exaggeration that the durability, the adaptability, and the degree of perfection already attained by this material, has within that short period revolutionized the architecture and building methods of two hemispheres.

" AMERICA," EXECUTED IN TERRA-COTTA.

This church, which is in many respects unique, was techinally described by the architect himself, in an address delivered before the Institute of British Architects in 1876, or thirty-two years after its completion, and from which we make the following interesting transcript. " This church was commenced in 1842 and completed, consecrated, and opened for public service in 1844. It is very easy to state this in a single sentence, but what is not at all so easy to do is to describe to you all the difficulties we had to encounter, all the laborious work we had to go through before this result was accomplished. It was, I believe, the first work of the kind in modern times in which terra-cotta had been used on so large a scale; for, with the exception of the foundations and the rubble work between the outer and inner faces of the walls, neither stone nor bricks were used, and with the exception of that under the slates, there is not a square foot of plaster in the building, the face of the walls inside and outside being formed of fire-clay blocks, in 5 in. courses, well bonded into the rubble work, and built like an ordinary ashler wall. It is a small cruciform church, with an apteral or aisleless nave, and a short chancel, north and south transepts, and west tower and spire. It is designed in the style of the early part of the Curvilinear period, *circa* 1320, with a spire of open tracery work, crocketed pinnacles, deeply molded door and window jambs, parapet of open tracery, traceried windows, and all other detail characteristic of that period, fully carried out. The four arches of the crossing are formed of continuous arches of two orders, carrying the Curvilinear ball-flower in one of their hollows. A trefoiled arcade runs round the three sides of the chancel below, and the north and south walls above carry a series of crocketed tabernacle work having niches intended for memorial brasses. All these works are in terra-cotta. The font, which is an octagon, richly diapered and paneled, is also in terra-cotta; so also are the bench ends, with their panels and finials; and so are the traceried panels of the seat backs themselves, and those of the pulpit and organ case. Indeed, the communion table was originally a terra-cotta structure, but it was objected to as uncanonical and ultimately removed, and replaced by a wooden table. . . . The most remarkable feature of the church, no doubt, is its traceried spire, which is built of solid terra-cotta from top to bottom, doweled together, not with iron, which is much less durable, not with copper, which is much more costly, but with terra-cotta dowels, which are imperishable. The six four-light traceried windows of the tower, transepts, and east end, and the two light windows of the nave, are treated in the same way. The church contains sitting accommodation for three hundred persons, and cost, as it now stands, £2,600. What it would cost in stone I never took the trouble to calculate: but the spire alone would, I should think, cost as much as the whole church has. Looked at as a piece of ordinary mason's work, it would be difficult to find a fault with it; nor would a stranger, seeing it for the first time, deem it, either from the appearance of its color or its workmanship, to be anything else. Its primitive color, when first built, was a ruddy buff, which isnow considerably deepened by an exposure of thirty years to the smoky atmosphere of Bolton-le-Moors."

The quarrymen, stonemasons, and plasterers became alarmed lest their occupation should be interfered with, though all the time affecting to regard the innovation as wildly Utopian, if not downright worthless. In this they were supported by that class of the community who, a few years before, had taken the side of the cow, as against Stephenson's locomotive, and who in another relation was once dubbed by Disraeli "the stupid party." As a result, and by common consent, this became known among them as — The Pot Church. In this, history was but repeating itself, and human nature was engaged upon an object lesson, to show that in reality it is much the same in all ages and nations. When Girolamo della Robbia, a grandnephew of Lucca, and an architect as well as a sculptor, built the Château de Madrid, on the Bois de Boulogne, for Francis I., the same thing happened. In it, also, terra-cotta had been extensively used, and the loggia was decorated with sculptured enamelled earthenware. For this it was nicknamed derisively by De Lorme, *Château de faïence*, and by this it continued to be known until destroyed by fire, in 1792.

(*To be continued.*)

Home Study is the title of a new periodical, the initial number of which makes its appearance this month. Its purpose is to provide through its columns an elementary study of civil, mechanical, steam, electrical, mining, municipal, bridge and railroad engineering, architecture, land surveying, mechanical, and architectural drawing.

It is published monthly, as an adjunct to The International Correspondence Schools, at Scranton, Penn., and, judged by its first number, will prove itself of great value to those desiring to take up these studies, but who are unable to take a course at some one of the larger colleges.

The Colliery Engineer Company, Scranton, Penn., publishers. Price, $1.50 per year.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

HIGH BUILDINGS.

BY C. H. BLACKALL.

WITHIN the past few months there have appeared in the various architectural publications a number of articles treating of the subject of high buildings. The term is used in the Chicago sense, implying buildings of fourteen stories and upward. These articles have come from architects and engineers who stand so high in their respective callings that whatever they say upon the subject is worthy of the most careful consideration. There seems to be a unanimity on the part of these writers to look discouragingly or with slight approval upon high buildings as a class, to consider them not only of doubtful expediency, but as in many cases a positive danger. Nor are there lacking evidences that legislative action is being considered which shall be intended to entirely prevent the future erection of buildings of more than a moderate height. Indeed, some cities have already passed laws of a restrictive nature. Boston does not permit of any building being erected over 125 ft. in height; Chicago recently restricted the height to 130 ft., but has since extended it to 150 ft., if I am correctly informed, and there has been a good deal of agitation in New York looking to the same direction. It is a subject which has engrossed a good deal of attention in the public press, and the daily papers, which are very quick to reflect any passing spasm of public opinion, have had a good deal to say about these "sky-scraping monstrosities," or by whatever other term the reporter's fervid imagination can picture them. The statement is reiterated that fire-proof buildings are not fire-proof; and the assumption is frequently made that some day there will be a tremendous catastrophe as a result of a conflagration in connection with some of the sky scrapers. We are told also that the buildings are not structurally safe, that it is not possible to guard the skeleton upon which they depend for strength from the insidious attacks of moisture and long-continued vibrations. And to sum up the evidence which is alleged against high buildings, one could very easily form the idea that our architects and constructors had lost their wits in dealing with this comparatively new problem, and that our large cities were being filled with structures which gratify only the immediate pecuniary interests of the owner, and possibly the personal pride of a few architects, at the expense of durability, safety, and public economy. It is an exception to find an architect who will say anything in favor of tall buildings, and yet the problem which they present is of so engaging nature, the possibilities which they place within the reach of the designer are so far in excess of anything which ordinary commercial architecture can offer, and the processes of construction, when rightly applied and thoroughly understood, are so eminently and scientifically satisfactory, that even in the face of the sentiment which seems to be growing against permitting their continued production, the question can fairly be asked whether there are not desirable elements in these sky scrapers, and whether the fault with them is not in the manner in which they are designed rather than in the problem itself.

The first requisite of all modern commercial buildings, even of restricted height, is that they shall be absolutely noncombustible, and, as far as possible, fire-proof. No one term is more persistently misapplied and misunderstood by the general public than the designation of fire-proof. Every day we hear buildings quoted as fire-proof which we know are inflammable to the highest degree. So much prominence has been given to the necessity of a construction which cannot be affected by fire, that, in the newspaper mind, every substantial pile of masonry which has the appearance of being solidly built is assumed to be up to the standard of fire resistance. But a mere lavish use of porous terra-cotta and iron will not make a building fire-proof. So long as we are obliged to use steel in the skeleton, the resistance of the building can be measured only by the protection of the most exposed portions; and as Mr. Adler very aptly says in the *Inland Architect*, "When structures intended to be 'slow-burning' burn quickly, and when 'fire-proof' buildings are materially injured or nearly destroyed by the burning of their contents, or by fires in neighboring buildings, we cannot evade the conclusion that the current theory and practise of 'slow-burning,' and of 'fire-proof' construction must be modified." As a matter of fact, many of the theoretically fire-proof buildings, — I use the term in the technical rather than the absolute sense, — while following the principles which modern constructive science has demonstrated as most reliable, are so deficient in absolute protection that their resisting qualities are of doubtful value. That a building can be so constructed that no fire from within can seriously damage its construction, and which will be proof against any ordinary fire from without, unless it be a general conflagration, seems to be pretty well established by the data cited in Mr. Adler's article in the *Inland Architect*. "The fire in the club house of the Chicago Athletic Association"— which offers a most conclusive test of our modern systems, — "occurred under peculiar and rather unusual conditions. The building was full of wooden scaffolding, and of acres of wooden wainscot, wooden doors, and combustible finishing material of all kinds, all stored in the building, some set in place, but most of it standing and lying about, while chips, shavings, etc., were scattered all over the building; everything in the best possible condition for quick combustion. The fire, therefore, spread quickly and burned fiercely. Everything combustible was consumed, and, as in the Schiller Building, the hollow fire-clay tile was chipped and cracked, and left the structural metal exposed to the action of the fire, from which it suffered some injury, but not enough to seriously impair its carrying power."

Now, while such an example is quite sufficient to demonstrate that, for existing conditions of occupation and use of buildings, it is impossible to construct any structure which is unqualifiedly "fire-proof," it also shows that when the structural metal work is properly protected according to the best experience of modern practise, the possible damage from fire, even under very extreme conditions, is reduced to an insignificant minimum. So far as I know, there has never yet been erected a building entirely devoid of combustible material. We still use wood for our doors, our windows, and generally for our finish and the finished floors. Also, the contents of a building is always of an inflammable nature. It is possible to avoid wood entirely, using marble or iron finish and iron doors and windows, and, perhaps, as has been suggested by Mr. T. M. Clark in a very able paper presented to the American Institute of Architects, we might substitute for ordinary glass, which will break and allow flames to pass, some form or variety of the recently produced wire glass which preserves its surface intact. The main constructive reliance of the building is, however, on terra-cotta, which, notwithstanding the advent of various other fire-proofing materials, still remains the most satisfactory material with which to clothe our steel skeleton.

The recent fire in the Manhattan Building, New York, while cited as an instance of a fire-proof building which was not fire-proof, was, in fact, a demonstration that the terra-cotta envelope really does efficiently protect. The report of Mr. S. A. Reed, published in the *Journal of Commerce and Commercial Bulletin*, is quite conclusive. The girders of seventh and eighth floor were unprotected and failed under the influence of the excessive heat. "Below that point I judge that the damage is confined to finish, trim, and exterior ornamentation, but is not structural. Had the girders and roof beams of this building been properly protected, I think most of the damage to the building would have been other than structural."

In the light of such evidence, it seems hardly fair to object to high buildings on the score of their fire-resisting qualities. We can never be relieved entirely from risk in any human habitation. We cannot conduct business in a structure built like a blast furnace. We must have abundant light and air, and the dangers from fire incurred in a tall building of fire-proof construction seem to me no greater than exist in a four or five story structure, and are surely far less than were endured for generations before modern construction was developed.

As regards construction, the high commercial structures of to-day are built on precisely the same lines which have been followed for upwards of half a century in erecting bridges. The ancients did not have iron to use in the lavish manner which is possible nowadays; but as a comparative construction, it is safe to say that the post and girder system adopted in nearly all architectural structures to-day is safer, stronger, less liable to be influenced by external shocks or internal commotions than any form of masonry construction, as such, which the world has ever seen. Surely no constructor will undertake to say that a tall building, if carried, even to a thousand feet in height, cannot be made of sufficient strength to withstand all that will ever be put upon it; and the use of the steel skeleton, continuous from bottom to top, permits of a certain flexibility in the construction, the value of which I think may not be fully appreciated. As regards the life of the steel when embedded in the masonry, we know that under some conditions steel has endured for ages; and while we also see abundant evidences that steel and iron beams will rust entirely away in a comparatively few years, there are always special and easily appreciated reasons for such deterioration, arising from conditions which experience tells should be and are avoided in the best arranged and constructed buildings. The expansion of the iron or steel under heat is quoted as an argument against its use. The objection is theoretical rather than practical, for the terra-cotta envelope expands as well as the metal, the rate of difference being only about one two-hundredth of an inch per foot for a change in temperature of 100 degs., which is equivalent to ¾ in. in 150 ft., or, at the most, $\frac{1}{15}$ in. per story, an amount too small to be considered. As a matter of fact, the range of temperature of the steel is less than 40 degs., which reduces the expansion to $\frac{1}{40}$ in. per story.

I would not be understood as saying that all high buildings are safely constructed, any more than that they are all fire-proof. Some of the structures erected in recent years are constructively a disgrace to the profession. Mr. Alex. Rice McKim, in a letter to *Architecture and Building*, says that "many of the so-called modern office buildings which we see about us are anything but well constructed, and the collapse of one of these would throw the whole system into disrepute, cause a stampede from the office buildings, and injure the profession considerably." This is one of the evils incidental to the practises of a profession which is open to every one who chooses to consider himself qualified.

From a business standpoint, no one can question the desirability of concentration, and this the sky scraper does most effectually. People may grumble at the shadows cast by the huge structures, and may even collectively, say that they ought not to be tolerated or allowed, but they answer a public necessity. The best commercial warrant for their being is afforded by the manner in which they rent, and we have only to look at the experience of nearly all the tall buildings which have been erected, to see that however much they may be objected to in theory, as a matter of fact, the top offices are the ones rented first, those nearest the ground bring the most money, and the ones which pay the least are midway, or at about the height of what we used to call tall buildings a few years ago. The possibilities of these buildings has so enormously increased the earning capacity of the land, that property which would hardly carry itself in former times on a valuation of one hundred dollars per foot, can now be made to yield a handsome surplus on a valuation of three hundred dollars, while modern machinery and business methods have made it possible to erect these excessively tall structures at a less price per cubic foot than was the rule a few years ago with buildings running up only 80 or 90 ft.

There remains, therefore, only one valid objection to the high building, the question of fitness in an esthetic or public sense. An architect who was for years at the head of his profession in Boston, whose word was accepted almost as law among real estate investors and all who had to do with real property, was quoted to me as having said he did not believe it wise to put an elevator in any commercial building; that if people were too lazy to walk up two flights of stairs they ought to stay outside, and that in no case did he think it advisable to carry a building up more than three stories. If I recollect rightly, the highest structure he ever built was not over six stories. Whether he built it under protest I could not say, but there is no reason to doubt that the sentiments which he felt were substantially as I have stated above. This was said before the first sky scraper was built in Chicago, and at a time when a building 80 ft. high was thought to be very high for Boston. It need hardly be added that this distinguished architect's views were speedily relegated to the past as the possibilities of modern commercial structures made themselves manifest. Nor is it likely that any architect of to-day would take so extreme a position; and yet the jump from a three-story to a nine-story building meant a great deal more in the architectural development of this country than has been implied by the transition from a nine to a nineteen story; and it is less of an achievement to-day to erect a structure 350 ft. high than it was a decade ago to build one 100 ft. high. Is it not then possible that we are not considering this problem right, and that by condemning the tall building, as such, we are taking a stand which in the future may seem as irrational as the position in regard to elevators previously quoted now seems to us.

Let us consider for a moment what the problem means. Reduced to its barest commercial elements, it is simply to get the greatest number of people safely housed in offices upon a given lot, utilizing every foot of space possible of land, which will often run up to nearly three hundred dollars per square foot. That is the economic problem. Architecturally, it means to design a tower, not very high in comparison with other towers, as such, but divided into numerous low stories, each of which must be recognized on the exterior in some way. I confess I do not appreciate the feeling which would prompt an architect to belittle the opportunities afforded by a high building. In no other department of art is mere size and mass as worthy of consideration as in architecture. Expanse or magnitude has very little to do with the intrinsic qualities of a painting or a statue, but an architectural creation which is simply immense, even though it be lacking in proportion, detail, and arrangement, is impressive, and may be noble as a design. The best illustration of this quality of architecture is manifested by the works of the Egyptians. Mere size is so great an aid to dignity in architecture, that the fact that we can logically carry a building up to a height of 300 ft. above the pavement ought not to be considered a calamity. If we were designing a cathedral, there surely would be no impropriety in carrying a tower up to 400 or 500 ft. I admit the essential difference between a cathedral, which is nearly always an isolated structure with abundant space around it, and a modern office building which is crowded into the narrowest possible compass and circumscribed by the limitations of an ordinary city lot. I admit the sentiment which would acknowledge the fitness of a church tower being carried up to the highest possible limit as a single structure, as compared with the seeming incongruity of piling stories upon each other like so many tables, but this is simply another way of saying that our tall office buildings are not designed right and are not placed right. Considered of themselves, irrespective of their surroundings, I do not believe a nobler, more inspiring problem has ever been presented to architects than is afforded by these huge structures. Let any one walk down Nassau Street from City Hall Square, or look up at the Ames Building from the corner of Devonshire and Congress, or pass under the shadow of the mighty Masonic Temple at Chicago, and he must be prejudiced indeed who can deny the grandeur, the intrinsic nobility of the structures he will see. I know all would not agree on questions of mass and of detail, and we are bound to admit that our streets are not desirable when they are turned into cañons; but the buildings themselves are certainly noble creations of a type which the world never has seen before in just such form.

It must not be assumed that the present is peculiarly an age of high buildings, for we cannot forget the numberless buildings of the past which are recognized as monuments, in every sense of the word, but which far excel in height everything which this country has ever produced, with the single exception, perhaps, of the Washington Monument, which, by the way, is not truly an architectural structure. The dome of the cathedral of St. Paul's, London, is 363 ft. high, St. Peter's, Rome, 435 ft. high. Both of these are buildings presenting considerable constructive difficulty; in fact, a dome put upon stilts and carried on arches is one of the most insecure forms of building which human ingenuity has ever devised. The towers of Cologne Cathedral are built up solidly to a height of nearly 400 ft., without counting the spire; and we have the enormous Victoria tower of the Houses of Parliament carried to a height of 340 ft., while from the remote antiquity we have the Pyramids of Egypt, which are about 484 ft. high. In other words, there are not lacking monuments of the past which are sky scrapers in a literal sense, but which are acknowledged to be art creations and thoroughly well constructed. So the modern sky scraper, while it may be new in the sense of its adaptation to office purposes, is not new in the slightest degree as regards dimensions.

The New York Chamber of Commerce recently passed some resolutions which are so pertinent and express so fitly the esthetic objection, as I understand it, to the high buildings, that they are worth citing. The first is, that the State legislature should pass a law limiting the height of buildings in proportion to the width of the street and according to location; and second, that all buildings over 80 ft. high should not occupy more than eighty per cent. of the area of the lot or lots upon which any one building may stand. If these resolutions could be carried out in effect, it would not by any means imply that high buildings should not be built; but rather, when a property owner makes up his mind to carry a structure to the height of three or four hundred feet, that he must consider his neighbors, and the general effect upon the street upon which he is to build, and must erect a structure which shall be in harmony with the general aspect of the city, rather than to stick up like a sore thumb, in the painful manner so evident on some streets. I believe in the high building, I believe in it architecturally, structurally, and esthetically when it is properly placed and designed, and I cannot believe the high building need be condemned as such. Very few of our tall office buildings are in accord with their locations and surroundings, but this is more due to the selfishness of the owners of high cost land than real lack of appreciation by the architects. We do not need to reduce the height of buildings, but rather, we want to reform the public taste and the greed of capitalists, so that we will design our tall buildings as monuments and not as mere money mills. We want high buildings. It is impossible, under existing conditions, to carry on business in the structures which our fathers found sufficient to their wants. Ten stories is not enough for modern commercial needs, and I will not believe that the possibilities of architecture are so barren a way cannot be found to carry up our buildings twenty or thirty stories, if necessary, without sacrificing the unity which ought to prevail in a well-regulated city.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Continued.*)

THE CHEMISTRY OF CEMENTS.

IN the American Cyclopædia, Vol. IV., page 185, the following singular theory will be found attributed to MM. Rivet and Chatoney: "Where cements are calcined at a high heat, silicate of alumina and silicate of lime are formed, which on the addition of water undergo decomposition with the formation of aluminate and silicate of lime, containing each three instead of six equivalents of water, which is the case when a heat only sufficient to drive off the carbonic acid of the carbonate of lime is employed; and the decomposition which must take place before the final hydration also explains the slow setting."

We thus have here a variety of opinions which to the lay mind must give rise to conjecture, at least, and to those who take a deep interest in the subject, and who desire to arrive at the truth, must certainly open a wide field for research and experiment.

With a view to the acquirement of some knowledge of a practical nature in regard to this question of chemical combinations, the author instituted a series of experiments, which, being entirely mechanical, except as to the analyses, were more or less crude.

One of these consisted in filling a gallon bottle with three quarts of rain water, into which were gradually sifted a few ounces of natural rock cement which had been calcined to an unvitrified clinker and ground exceedingly fine.

The bottle was shaken vigorously and continuously for several minutes, thus giving the water ample time to act on the powder before the latter was allowed to settle. This operation was repeated at frequent intervals to avoid a setting of the cement, as would have been the case if left undisturbed. The following day the water was poured off, and a new supply used. After the third washing the cement was dried and submitted for analysis.

Previous to the experiment the cement had been carefully analyzed. The following table gives the analyses. No. 1 before, and No. 2 after, washing.

	No 1.	No. 2.
Silica	24.30	26.01
Alumina	6.62	7.07
Oxide of Iron	2.41	2.16
Lime	52.35	51.97
Magnesia	6.16	6.52
Potash and Soda	5.30	2.77
Carbondioxide	2.10	2.26
Loss	.76	1.24
Totals	100.00	100.00

The constituents which show an increase in percentages are those which sustained no loss in the washing, while those which show a decrease lost a portion in the operation, which becomes more noticeable when illustrated by ratios.

	No. 1.	No. 2.
Ratio of silicic acid to lime, as	10 to 21.5	10 to 19.9
" " " " , alkalies, as , , ,	10 to 2.17	10 to 1.06

The ratios as between silicic acid and the magnesia and alumina are practically constant.

It is not contended that this experiment is at all conclusive, but it furnishes evidence that magnesia and alumina were chemically combined with the silica, else they certainly would have been washed out, or at least partially so.

The loss of 7.45 per cent. in the lime amounts practically to the excess above its true combining ratio with silicic acid, which is as 10 to 18.6.

The prime object of this experiment was to determine the truth or falsity of the theory so often advanced, that the magnesia and alumina are inert substances in a cement, and the results demonstrate that, by a careful system of washing, all inert or uncombined matter may be removed.

The fact that neither magnesia nor alumina are separated from the silica except by the use of acids, as in analysis, should be a sufficient refutation of the idea that either of those constituents are free and inert in a cement.

The difficulties in the way of a settled theory concerning the fabrication of a cement are furnished by the almost interminable variations in the percentages of the constituents, silica, alumina, lime, and magnesia.

A study of the table of analyses will disclose the fact that no two cements are alike in this respect, and every change from some fixed standard, with the varying action due to that divergence to be accounted for, involves the subject in doubt, and opens the way to endless discussion among those who make a study of the chemistry of cements; while engineers, architects, and others who are in a position to determine the brand of cement to be used, are guided by practical experience in the use of the various brands, paying but little regard to the chemical side of the question.

They find that for some purposes one brand of cement answers, while for another class of work some other brand is preferred. It matters little to them whether one brand contains a greater or less amount of magnesia or alumina than the other. They desire a satisfactory result, and, as a rule, are far less prejudiced than any other class connected with the art.

A cement manufacturer who does not fully and unequivocally believe his own production to be in every conceivable way superior to all others is yet to be found.

It is a fact familiar to all who are interested in the subject of hydraulic cements, that the question of quality is ordinarily determined by tensile strain test. It is a convenient method of reaching conclusions as to the relative values of different brands of cements.

That slight attention is given to the analysis of a cement is due to the fact that a mere analysis, as it appears in a table, does not convey to the average mind any definite meaning.

And when several analyses are compiled in one table, there is a confusion of ideas as to the significance of the almost endless variety of compositions that exist; and it is not difficult, therefore, to account for the almost universal use of the tensile-strain testing machines.

It should be understood that an analysis stands mainly as a basis for further calculations. That it is but the statement of a problem, the conclusions of which, when worked out, will disclose the percentages of silicates or active setting matter in the cement, and, consequently, the percentages of inert substances; for that the constituents, silica, lime, magnesia, and alumina do combine chemically in fixed proportions, is a fact established beyond all controversy.

If all cements were found to contain these constituents in true combining proportions there would be but little left to be said on the subject. But as such conditions are rarely, if ever, met with, the most that can be done toward arriving at actual values is to determine, from a given analysis, the amount of silicates, and the amount and kind of inert matter present.

When a system for so doing is clearly understood, a long step will have been taken toward a clearer and better understanding of the actual merits of a cement.

It will then be discovered how utterly unreliable and misleading are the readings of a testing machine, unless held in strict subserviency to a superior knowledge, gained only by a thorough study of the chemistry of cements.

As a simple method for calculating the percentages of silicates in an hydraulic cement, the analysis of which may be given, we have prepared the following formulæ, which will be found to serve the purpose.

COMBINING RATIO OF THE VARIOUS SILICATES.

SILICATE OF LIME.

A.		B.	
Silica	1.000	Lime	1.000
Lime	1.864	Silica	.536

SILICATE OF MAGNESIA.

C.		D.	
Silica	1.000	Magnesia	1.000
Magnesia	1.330	Silica	.752

SILICATE OF ALUMINA.

E.		F.	
Silica	1.000	Alumina	1.000
Alumina	.566	Silica	1.764

BISILICATE OF LIME AND ALUMINA.

G.		H.		I.	
Silica	1.000	Lime	1.000	Alumina	1.000
Lime	1.864	Alumina	.304	Silica	1.765
Alumina	.566	Silica	.536	Lime	3.291

BISILICATE OF LIME AND MAGNESIA.

J.		K.		L.	
Silica	1.000	Lime	1.000	Magnesia	1.000
Lime	1.864	Magnesia	.356	Silica	1.503
Magnesia	.665	Silica	.536	Lime	2.803

TRISILICATE OF LIME, MAGNESIA, AND ALUMINA.

M.		N.		O.		P.	
Silica	1.000	Lime	1.000	Magnesia	1.000	Alumina	1.000
Lime	1.864	Magnesia	.356	Alumina	.852	Silica	1.765
Magnesia	.665	Alumina	.304	Silica	1.503	Lime	3.291
Alumina	.566	Silica	.536	Lime	2.803	Magnesia	1.172

(*To be continued.*)

THE MANUFACTURE OF CONCRETE.

MIXING.

THE mixing of concrete is as essential to success as the choice of the materials used for it. With unskilful methods there may be a vast amount of waste, both in the quantities of materials used and in the final strength of the concrete mass. It is possible to obtain as strong and as satisfactory results with a small amount of cement and a large amount proportionally of well-chosen aggregate as with a large amount of cement and haphazard mixing with ill-chosen aggregate.

In any good concrete the main object is to fill the voids. The spaces between large stone should be filled with smaller stone; these spaces so reduced should in turn be filled with sand of a coarse variety, and then the smallest spaces filled entirely with cement. Every piece of stone and particle of sand, therefore, should be coated well with cement, and the best results are obtained when there is not too much of any material,—stone, sand, or cement. Large masses of pure cement scattered through a mass of concrete shows a waste of good material, for a piece of good hard stone would do better work in the place of the mass of cement, and it would cost a fractional part as much.

There has been more or less discussion as to the kind of material that is best in concrete making. First, in regard to the size: For heavy and massive work, large stone may be used, sometimes as large as a man's head. Then the rest of the stone may be graded down so as to have the spaces between the stone well filled. The matrix should be composed of coarse sand, at least as large as the coarsest granulated sugar, and the cement should be thoroughly mixed with this sand before the mortar so formed is incorporated with the stone. Only sufficient water should be used to insure secure a stiff tenacious mass. It is often advisable to wet the stone and coarse material before mixing.

As for the kind of aggregate, that depends wholly on the use to which concrete is to be put. For heavy loads and masonry of high order, only hard broken stone, basalt, granite, etc., should be used. For fire-proof work, use broken brick, pottery, clinker, slag, and such material as withstands great heat.

For light floors, filling, etc., use crushed coke, clean cinders, etc. For heavy wear in pavements use pea granite or other hard stone. (See specifications in back numbers of BRICKBUILDER.)

There is a good deal of controversy at present among engineers as to the relative value of broken stone and round pebbles in making concrete. Tests have been made which show no practical difference in the strengths of concrete made under similar conditions with the two materials, yet judgment and reason would certainly choose stone in place of pebbles, for important work.

There is often a confusion of ideas in naming the proportion of the materials for making concrete, due to the fact that it is not generally understood that three parts of sand and six parts of coarse 2 in. stone do not make nine parts together. The voids in coarse stone amount to about 47 per cent. of the mass, or, roughly, 50 per cent., which means that it is necessary to add to a certain mass of stone nearly half as much sand in order to fill the voids without increasing the bulk at all. According to Trautwine, the following table gives the proper ratio.

1 cu. yd. broken stone with .5 of its bulk voids requires	.5 cu. yd. gravel or fine stone
.5 ,, ,, gravel or fine stone, with .5 of its bulk voids requires	.25 cu. yd. sand
.25 ,, ,, sand with .5 of its bulk voids requires	.125 cu. yd. dry cement

So when a mixture is stated by the formula 1 — 3 — 6 — the result is a mixture of one part of cement to six parts of aggregate, and not of nine parts of aggregate, as might be assumed. This is a matter of much importance, not only in estimating, but in the strength of the concrete, for if one mixture is made of one part cement and, say, six parts of broken stone, and another mixture is made of one part cement, two parts sand, two parts of small stone, and six parts of large stone, the result of the second mixture will be far superior to the first in economy of materials, volume, and equal in strength. In all cases this idea should be developed to its fullest extent, where concrete is used intelligently.

Here, however, comes another idea of importance relating to the manner of mixing, whether it is to be done by hand or by machine. If it is to be done by hand, account is to be taken of the uncertain quality of the labor. The energy required for mixing concrete is excessive, and the work is very fatiguing. It is harder to handle stiff concrete than one which is soft. The temptation then is to use too much water, which drowns the cement and wastes it. The mixture should be turned a number of times to insure a thorough distribution of cement and to fill the voids uniformly. The tendency, however, is to save time and labor, and, consequently, to avoid mixing as much as possible.

These difficulties are largely obviated by using machinery of approved type. A large number of the mixers, however, consist mainly of a trough and a shaft to which are attached a number of paddles. This style answers well where large quantities of material are wanted without particular reference to its quality, as in street and reservoir paving, cable subways, etc. They are inferior mixers, and not economical where the full value of the materials is to be used.

ROSS F. TUCKER.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

CRACKS IN BRICKWORK AND PLASTERING.
WHAT CAUSES THEM, AND HOW THEY MAY BE PREVENTED.

BY A. H. DYER.—(*Concluded.*)

NO architect or builder would think of constructing a brick wall in the manner shown by Fig. 38, which represents a section of a 12 in. wall with a continuous horizontal chase or groove (A) running the full length of the wall, and extending to the outside course of brick, leaving out the center and inside courses the thickness of one brick. Such a form of construction would seem to be the height of folly, if not of criminal carelessness. The writer does not remember seeing an absolute case of this kind, but he was called upon to witness an example which practically amounted to the same thing. The example referred to was a two-story factory building with 12 in. brick walls and 2 x 12 in. floor joists resting upon a 2 x 8 in. bond timber built into wall, as shown in Fig. 39, all of the timbers being yellow pine. When this building was about four years old an accident happened which brought to light the fact that the first floor had *settled* near the outside wall, and for a distance of about 30 ft. and a further examination disclosed the fact that the ends of many of the joists, as well as most of the bond timbers, were almost entirely consumed by *dry rot*, and the latter in many cases to such an extent that the entire space formerly occupied by the bond timber could be readily "cleaned out" by using a piece of wire or hoop iron, and in some cases bare fingers could easily accomplish the same result. Many of the joist ends were in such a condition that, while at first they appeared to be sound, a knife blade could be easily pushed through them at right angles with the grain of the wood. With this state of affairs existing along almost the entire length of the wall, it must be admitted that *practically* the method of construction was the same as that shown in Fig. 38. The second floor was constructed in the same manner, and had begun to show signs of decay, but not nearly as bad as the first floor. The whole thing was "*fixed*" by setting props under the first floor joists, the bottom of props resting upon the top course of footings to outside walls, and closing up the cellar again so that the good work might continue uninterrupted. The above method of construction was no doubt adopted in order to get a "good bearing" for the joists, and at the same time save anchoring them, as each joist appeared to have been thoroughly spiked to the bond timbers. The writer several years ago saw another case where considerable "bearing" seemed to be needed, for the builder had run the second-story joists entirely through the wall, and the ends were painted and lined to correspond with the brickwork; the painting was very neatly done, and if the ends of the joints were dovetailed and wedged it could not be noticed from the ground, and it is quite possible that they were "draw bored and pinned" against the inside of the wall to prevent some one pulling them out when the owner was not looking.

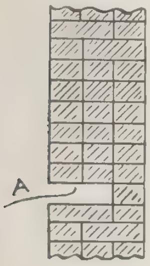


FIG. 38.

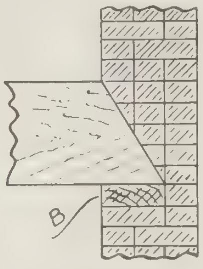


FIG. 39.

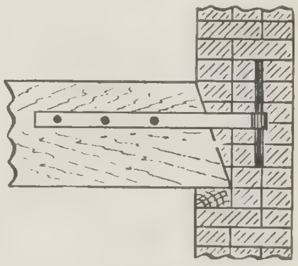


FIG. 40.

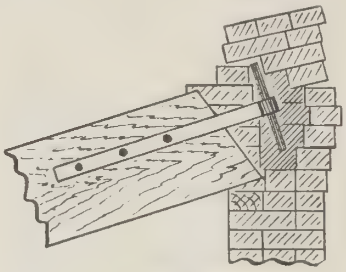


FIG. 41.

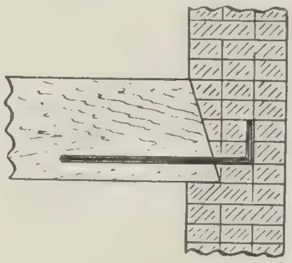


FIG. 42.

When joists are built into the wall and secured with iron anchors it would be well to consider which method of anchoring is the best, and it should also be remembered that all joists and timbers resting in or on a wall should be "self-releasing" in case of fire or accident. One of the most common patterns of a joist anchor is that shown by Fig. 40; it might also be added that it is one of the worst, and a quite frequent result of their use is shown by Fig. 41. Fig. 42 shows a cheaper and also a better anchor than any "stiff" anchor for ordinary purposes; it is made of plain, round iron, with the inner end turned and driven into a hole of proper size in the joist; this anchor will allow the joist (if properly beveled) to leave the wall without acting as a lever, but the joist itself will not be released. Figs. 43, 44, 45, and 46 describe an anchor that is self-releasing, and one that will be self-adjusting in case of any ordinary settlement, and it is no more expensive than the old-fashioned "pry" anchors that are still quite extensively used. I examined a brick building not long since that had two heavy truss chords, which were anchored to opposite walls with very heavy anchors, two at each end, and secured by four bolts, the anchors being the same style as shown by Fig. 40. The center of these chords had settled to such an extent that the brickwork around each of the ends (four of them) was broken and pulled in to such an extent that the anchors did not hold one single pound more than the weight of the mass of broken brickwork immediately in front of them, and in all cases this brickwork was easily removed, as the fracture extended into the wall as far as the anchors did; this fracture could not have happened if an anchor similar to Figs. 42 and 43 had been used and properly adjusted. It will be noticed that in case of fire the expansion of these anchors, although it would indeed be very slight, will assist, instead of helping to prevent the release of the joist, and if properly set, it will also

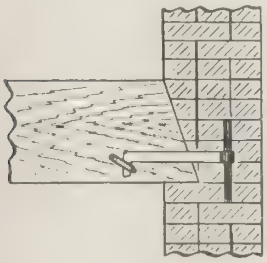


FIG. 43.

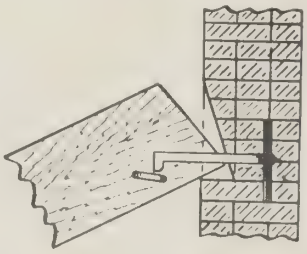


FIG. 44.

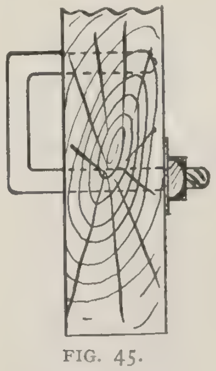


FIG. 45.

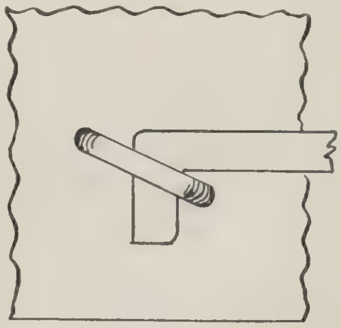


FIG. 46.

adjust itself to any reasonable settlement without diminishing its strength.

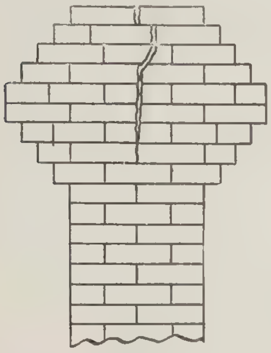


FIG. 47.

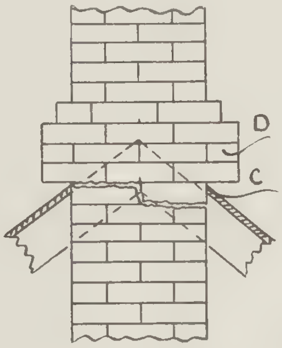


FIG. 48.

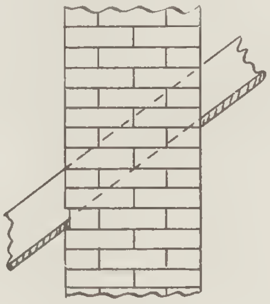


FIG. 49.

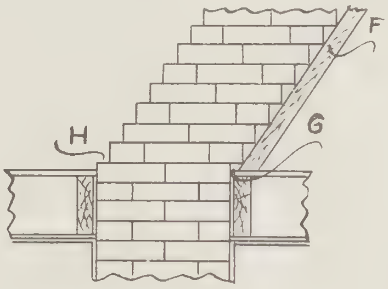


FIG. 50.

Again taking up the subject of cracks, we will investigate a few cases of defective flues. In constructing chimneys for frame buildings it should always be remembered that the footings of a chimney should have as nearly as possible the same load per square inch as the footings of the foundation walls have. But this is too often left to guesswork, and, as a rule, the figuring and guessing bring about very different results. Fig. 47 shows a very common case of defective chimney top, and is caused by "too much projection." Fig. 48 shows a first-class case of defective flue, and it is by no means an uncommon one; any settlement of the chimney is liable to cause the base D to ride the roof at C, and thereby cause a fracture, as shown, or at some point lower down, as the case may be. The unerring accuracy with which the courses usually "line up" with the top of the roof boards around the opening is something remarkable, and just why this method of construction is so persistently followed and so freely allowed is more remarkable still. Fig. 49 shows a similar case, where the opening was *almost* large enough, and the chimney was "wiggled through," with about the same result as shown by Fig. 48. Fig. 50 shows an example of "drawing over" so as to bring the chimney through the roof at some certain point. The inclined portion of the chimney is usually supported by plank at F, but no provision is made to keep it from sliding off at H, which will sometimes occur if the inclined part is too much out of plumb; and, again, if any settlement occurs the upper part of the chimney is liable to be "hung up" at G, or at almost any point along support F. Fig. 51 shows an *easy way* to get around a floor or ceiling joist without "bothering the carpenter," and, as increditable as it may seem, it is very frequently done, and thereby hangs another case of defective flue. Fig. 52 is another pronounced case, and it quite often leads to a "fire from unknown cause," just the same as Fig. 53, in which case the flooring is butted close to chimney; the plastering extends clear to floor, and is still more closely confined by the base and foot mold being nailed to flooring and joists, and it then becomes a matter of comparative strength as to which gives away first, the woodwork or the brickwork. Sometimes a combination is made of Figs. 52 and 53, but the benefits to be derived therefrom will have to be determined by the amount of insurance that has been placed upon the building at some previous time. Fig. 54 shows a common-sense way to finish around a chimney. It will be seen that the floor does not extend beyond the base line, and that the woodwork is in no way tied to or hung to the chimney. A perfect chimney should have a perfect foundation; but the *danger* that may result from an imperfect foundation can be almost, if not entirely, avoided by having the chimney plumb from bottom to top, and be entirely free from anything that will in any way interfere with its uniform settlement, provided that it will settle to a greater extent than the outside walls of the building. A "bracket chimney" can be made safe, but not by the somewhat usual method of having it supported by a double, or perhaps single joist that may have already been overloaded by the partition itself, and then hanging the chimney to the floor or roof above. For instance, a two-story cottage of ordinary size, and having a half-pitch roof, will require at least 26 ft. of chimney, provided that it starts from the first floor, taking an 8 x 12 in. flue for example, and you will have about 4,400 lbs. of brickwork resting upon a base about 16 x 20 ins., *or a load of more than 1,900 lbs. per square foot*, and in a majority of cases there will be no direct support for this weight below the first floor. Add to this fact the usual settlement and shrinkage, then add a case of Figs. 48, 49, 50, 51, 52, or 53, and the result is very liable to be a case of "defective flue."

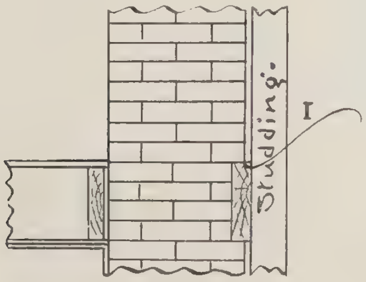


FIG. 51.

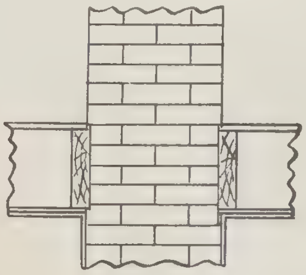


FIG. 52.

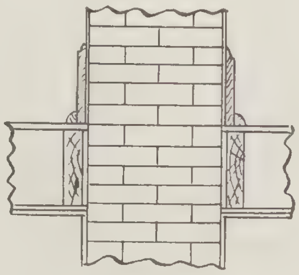


FIG. 53.

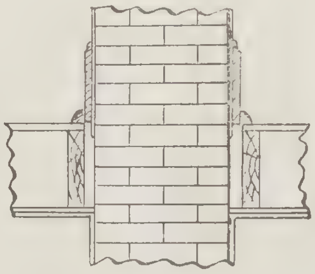


FIG. 54.

The only reliable way to prevent the almost inevitable crack between the woodwork and brickwork of a bracket chimney is to use a wrought-iron bracket covered with wire or metal lathing. The mason is not always to blame for defective flues; the carpenter is more often to blame than he, and the owner is very frequently more to blame than either of them. Some of the above examples might appear to be somewhat overdrawn, but it is nevertheless a fact that all of them, and more, too, can be found in nearly all towns and cities that have no ordinances or building laws to prevent them, and it is also true that the proper authorities of many towns and cities of considerable size cannot be prevailed upon to pass such laws, though for what reason it would be a hard matter to determine; such laws would not by any means increase the rates of insurance, nor would it increase the expenses of the fire department; it would not be any additional expense to the owner; neither would it be of any particular disadvantage to the reputable contractor, and it is not likely that the architect would have any serious objection to such laws, but there are people who will persistently fight against "safe construction" of any kind, and, therefore, the defective flue *must stay*.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

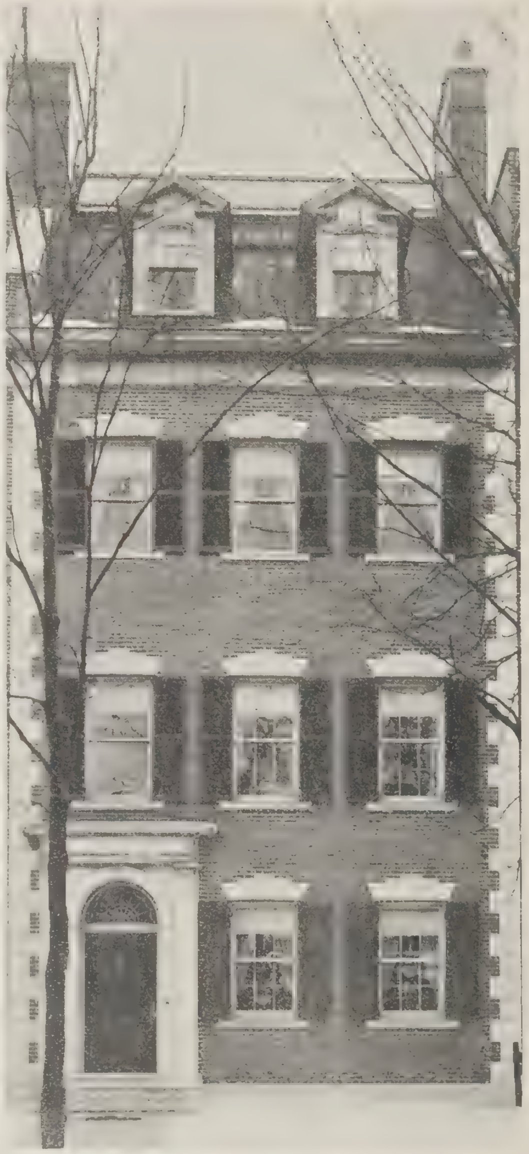
NEW YORK. — It is the day of big things in buildings in New York. Statisticians report an enormous amount of building, in dollars and cents, during the past year. Yet it is patent that this has been expended upon a few large buildings, not upon the ordinary four or five story houses, and stables, and factories, and stores and tenements. Some of this sort of work of course goes on all the time, but the great bulk in value is attributable to the overtopping office buildings, the ten, twelve, and fourteen storied mercantile buildings, all of the new type of brick or stone encased iron frame construction.

The biggest thing of this sort just now going on is the new dry goods store, or, more properly, department store, for Siegel, Cooper & Co., DeLemos & Cordes, architects, at the corner of Sixth Avenue and 18th Street, extending along the block frontage two hundred feet to 19th Street, and covering three or four hundred feet in depth of the block.

It is now up to the fourth tier, built of white, or light cream-colored brick, with the usual incidents of marble-columned entrance porticoes, so far; and, no doubt, to blossom forth as it goes up with garlands and terra-cotta escutcheons, and cornices of terra-cotta, perhaps, more probably galvanized iron; for on so large a mass even a few cents per foot difference in cost makes many dollars difference in the whole. It is to have a rotunda internally and a tower externally, — rotunda and dome not coincident in plan, quite unrelated in fact.

It is only fair to abstain from criticism until it is done, but one may say that it promises not to present any harsh contrast in style with the large commercial buildings near, O'Neill's, Altman's, Macy's and the rest.

The Syndicate Building at Liberty Street and Nassau, a new tall office building, is about done externally. It stands opposite to the Mutual Life Company's building, high, but not so high, although the difference is of no great account from the street. A hundred or a hundred and fifty feet of perpendicular precipice, on each side of a rift called a street, about thirty feet wide from building line to building line, is sufficiently imposing and not more disproportionate than a six-foot street in Constantinople with its thirty or forty foot flanking houses. One distinct advantage there is in narrow streets, — they are cool in summer and warm in winter; in fact these might count as two distinct advantages.

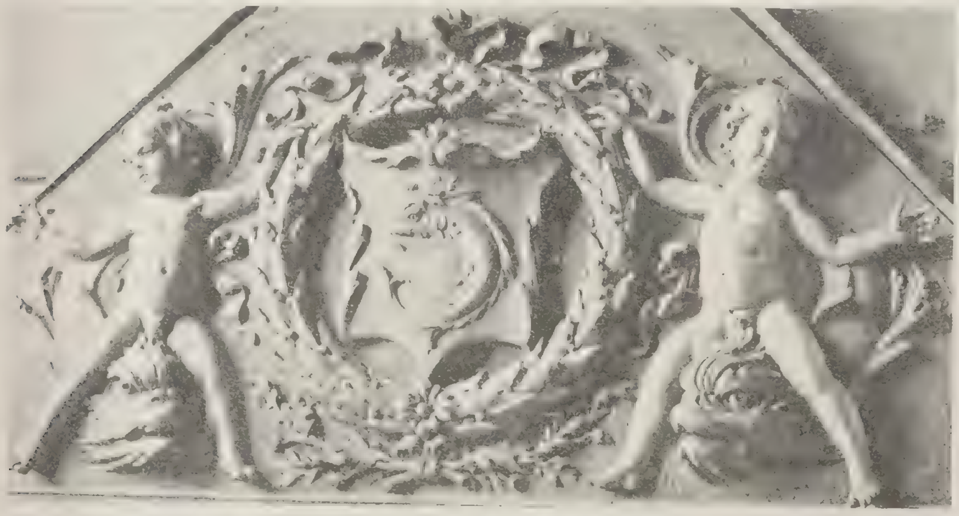


A COLONIAL RESIDENCE, BUFFALO, N. Y.
Boughton & Johnson, Architects.

The building law is again in process of revision by a large and competent committee, comprising many sub-committees. The only difficulty thus far met is that committeemen will not come to meetings. This causes some embarrassment, but doubtless, they who are running things know what they are about, and will see that a new measure is approved by the committee at the proper time.

It is reported that the revised law will require crossbridging to be nailed at each nailing with three twelvepenny nails instead of two tenpenny, and will include other tuppeny clauses to render building more secure, and to recruit the ranks of the reform office-holders.

The Architectural League Exhibition opened on the fifteenth of this month, and is to be free, except on certain days, depending for income, we presume, on sales of catalogues, which are every year larger, and on the concomitant and lucrative ads.



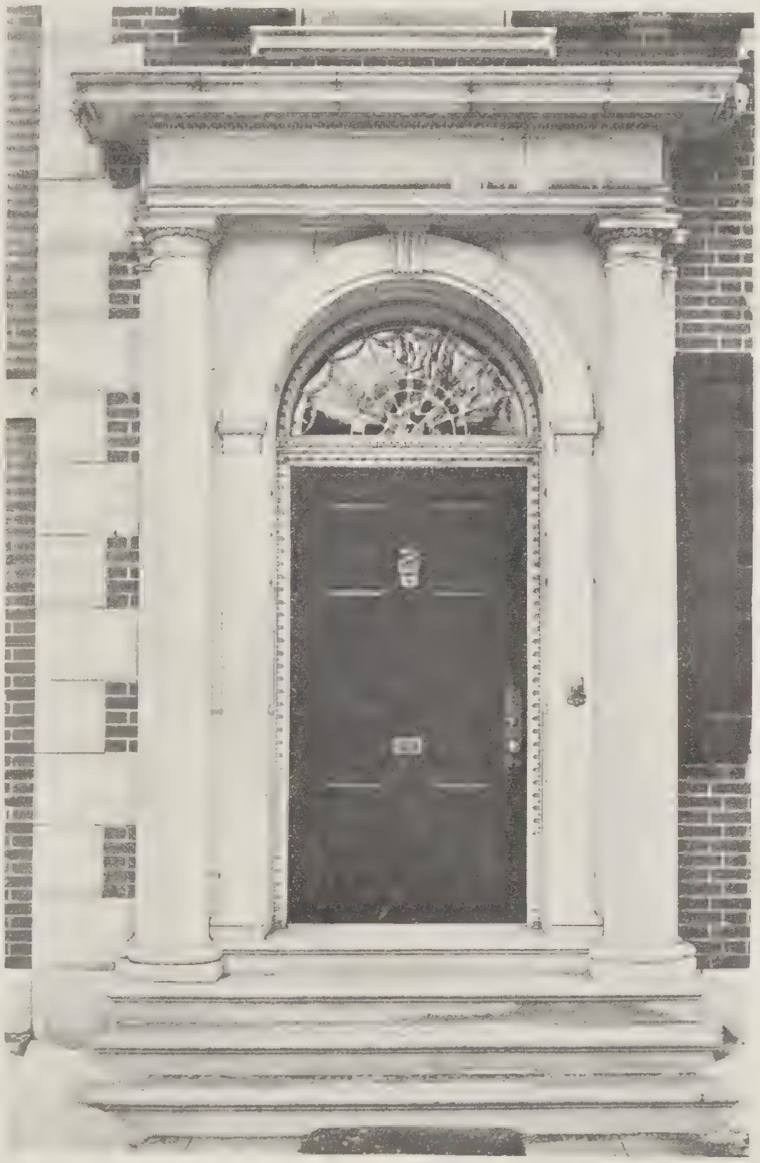
TERRA-COTTA DETAIL OVER ENTRANCE OF THE FISHER BUILDING, CHICAGO.
D. H. Burnham & Co., Architects. Executed by The Northwestern Terra-Cotta Company.

CHICAGO. — There is nothing sensational to record of Chicago building news this month. The statistician tells us that his figures show a decided improvement over the corresponding month a year ago, and certainly, prospects for spring building seem good. As some architects express it, "We are making a good many sketches." Aside from the usual list of minor structures and the mass of apartment buildings, there are quite a number of large possibilities talked of. One project, for a large office building in the "down town" district, on the site of the Grand Pacific Hotel, is postponed for a time. This is one result of the fact that the supply of offices is at present quite complete, and it serves as a check on new schemes. But the fact that a new city ordinance has just raised the limit of height from 130 to 155 ft., is certainly having an encouraging influence. The old ordinances limited fire-proof construction to 130 ft., and allowed combustible construction 100 ft. high. This did not put a premium on fire-proofing methods. Instead of decreasing the combustible limit to 80 ft., as desired by the local chapter of the Institute of Architects, the other limit was raised to 155 ft. Several new office buildings, which seemed to have been waiting for the new ordinance, are now talked of. The new Davies Building, which has been mentioned previously in this column, will have three additional stories at once.

Speaking of colors: the white terra-cotta and buff brick of "The Old Colony Building," and the full glazed cream-white terra-cotta "Reliance Building," are being followed by quite a train of light color. The new "Great Northern" office building and theater is beginning to show an exterior of terra-cotta as nearly a dead white as could be obtained, and in detail the design is Gothic, following the Fisher Building which had the same architects. The Fisher Building, however, is yellow in color. The office building on Washington Street, which will be ready soon for its roof, has a front of white terra-cotta, each block of which has the appearance of having been carefully dabbed with a small brush of pale brown paint. The artificial appearance may be softened by the Chicago atmosphere, and have a very agreeable effect. A polychromatic experiment was tried for this same building, but not being deemed successful, two or three stories of terra-cotta went to the waste heap.

The future is to be dreaded, which may see some awful combinations of colors on buildings instead of the waste heap.

The next acquisition in the campus of the University of Chicago will be to accommodate the biological department. Four buildings connected by peristyle (so Mr. Cobb's preliminary sketches say) will surround a court beautified with lakes, fountains, and flower gardens. The uniformity in design of the present fine group of buildings will be continued.



ENTRANCE TO COLONIAL RESIDENCE, BUFFALO, N. Y.
Boughton & Johnson, Architects.

PITTSBURG. — Last year was an "off year" in the building line in this city; the number of buildings erected was 215 less than in the previous year; although fewer in numbers, there were 183 more of brick than in 1894; that is, brick as against frame, saying nothing of those of steel and terra-cotta. The quality was better, and therein may be seen the faith which the owners and architects have in the future of this city.

Pittsburg is somewhat behind in having many large office buildings; although several have been built in the past year or two, and others are at present under way, they are all built on a substantial basis. Among the best of these may be mentioned the Carnegie, Conestoga, Tradesman, and Park Buildings; the last two are not yet quite finished.

Architect F. E. Rutan has prepared plans for a handsome apartment house to be erected on Penn Avenue, and to be known as the "Bachelors' Apartment House." Architect Jos. Stillberg will prepare plans for an auditorium to be added to the Exposition Building to cost about $25,000. Architect F. J. Osterling will prepare plans for a handsome brick residence for T. D. Armstrong, the cork manufacturer, to cost about $20,000. Architects Longfellow, Alden, and Harlow have prepared plans for a $50,000 mansion for Capt. J. J. Vandergrift, to be erected on Fifth and South Highland Avenues. It will be of the French Renaissance style, 75 by 90, built of Pompeian brick and stone with ornamentation of terra-cotta work. The steel structure of the fifteen-story Park office building is about finished and the filling in of the brick and stone work is going on at a rapid gait; the fire-proofing of this building is being done by the Pittsburg Terra-Cotta Lumber Company.

MINNEAPOLIS. — Our dull season is now a thing of the past, and there is abundant reason for expecting the best building season we have experienced for several years. It is probable that a great deal of heavy work will be undertaken which will make a much larger showing for the year 1896. Rumors are rife as to the intentions of property owners, which give us the right to figure on some rather large building operations this year.

Among the larger undertakings already decided upon are the following: —

F. A. Clarke, architect, has planned a flat building for Mr. Mann, of Boston, Mass., 135 by 140 ft., three stories and basement, pressed brick, to contain twenty-nine apartments, cost estimated at $75,000. Same architect has planned a two-story flat building 55 by 200 ft., containing twenty apartments, to be faced with pressed brick and to cost $30,000.

Wm. Deering, of Chicago, will build a five-story business building at corner of 4th Street and Second Avenue, south, 90 by 110 ft., St. Louis pressed brick, slow-burning construction, at an estimated cost of $150,000.

Long & Kees have made plans for a warehouse 60 by 160 ft., six-story, mill construction, pressed brick fronts, to cost $40,000. Same architects have also planned a hotel building 50 by 152 ft., four-story, to build on 7th Street between Nicollet and Hennepin Avenues, with pressed brick fronts, to cost $35,000; business block at 5th Street and Second Avenue, south, 88 by 132 ft., three-story, cost $20,000; warehouse building 97 by 158 ft., two stories and basement, mill construction, pressed brick front, cost $50,000.

W. S. Hunt has planned a church for Northeast Minneapolis, 72 by 88 ft., pressed brick fronts, to cost $8,000.

MARVELOUS STRENGTH OF A FIRE-PROOF FLOOR.

IN the Boys' High School of Philadelphia, the fire-proofing is being done by the Fawcett Ventilated Fire-proof Building Company, Limited, of the same city.

The first floor is constructed of 6 in. steel "I" beams, 13 lbs. per foot. The spans were 18 ft. long, and the beams are set 2 ft. centers. The terra-cotta lintels had been set in place and concreted over top of the same, up to the level of the top of the beams. This part of the work had been done for over two months. A few nights ago, during a heavy gale, a boom of one of the derricks became loose and swung around, and knocked down a line of columns and girders in the course of erection on the fourth floor. One of the cast iron columns struck a girder and broke in two. A portion of this column, weighing 432 lbs., fell to the first floor, a distance of 32 ft., striking the Fawcett floors endways, directly between the floor beams, and nearly in the center of the span, breaking a hole in the floor less than 3 ins. in diameter. The column fell over on the floor without further damage. It is estimated that the column struck the floor a blow of 13,888 ft. lbs., without further damage to the floor than the 3-in. hole referred to.

By looking back over the record of tests made by Mr. Geo. Hill, civil engineer of the various methods of fire-proofing, and recently published in The Brickbuilder, one will more fully appreciate the wonderful strength of the Fawcett System of Fire-proofing, which is fully illustrated on page x of this issue.

THE accompanying cut illustrates the new Lithgow Library building at Augusta, Me. It is built of the best quality of Maine granite, and is roofed with dark red vitrified tile of the patent closed-shingle pattern, manufactured by Charles T. Harris, lessee of the Celadon Terra-Cotta Company, Ltd., of Alfred, N. Y., whose product has been used on many of the finest buildings in New England.

The contrast between the granite walls and tile roof is strikingly beautiful, and yet in perfect harmony with the general style and artistic character of the building, which was designed by architects Neal & Hopkins of Pittsburg, Penn.

The general architecture is of the Romanesque-Renaissance school. The outside of the structure may be alluded to as quarry-faced ashler with line trimmings. The chimneys, instead of being deformities, are truly ornamental.

The names of authors famous in the world's annals are carved in the panels and medallions on the exterior of the building.

Entrance to the building is under a beautiful Roman arch supported by massive pillars. The rotunda is supported by eight Ionic fluted columns.

At the left of the entrance is the book room, which has twelve steel memorial alcoves, each holding from twelve hundred to fourteen hundred volumes.

In the advertisement of the Celadon Company, on page xvi, we illustrate another New England library just finished, the roof of which is covered by Conosera Red Tile.

SEMI-OCCASIONALLY some prominent architect will, unsolicited, indorse the position taken by The Brickbuilder, that examples of the higher ideals of the trades it represents are not wanting in these days of haphazard methods. We are glad to print the following letter, which needs no further comment: —

E. A. Kent, Architect,
White Building.

Buffalo, N. Y., Jan. 28, 1896.

New York Architectural Terra-Cotta Company,
38 Park Row, New York.

Gentlemen: The work you did for the Chapin Building here is so thoroughly well modeled, colored, and burnt that I want to send you an unsolicited testimonial, if such a thing is of value, and to say that it is not only the best work I have had done, but the best work I have seen anywhere. Very truly yours,

(Signed) E. A. Kent.

THE Tiffany Pressed Brick Company, Chicago, has issued a neat little booklet which gives the sizes, colors, cost, etc., of their make of enameled brick. Added to this are indorsements from leading architects, of their product, with a list of some of the more prominent buildings where "Tiffany" enameled brick has been used.

THE Reconstructed Granite Company, Wm. Courtenay, president, office, 14 Dey Street, New York, is looking for a site in or near New York City on which to build a factory for the manufacture of "Reconstructed Granite" for architectural and ornamental uses.

Mr. Courtenay is desirous of securing a brick or terra-cotta plant that could be easily converted to the requirements of his company.

THE new catalogue just issued by the Boston Fire-Proofing Company is a credit to both this company and its printer. It is printed in pocket size, and contains several finely finished half-tone illustrations of many of Boston's most representative buildings which this company has fire-proofed.

It is comprehensive and concise, and deals with the subject very thoroughly. Its analysis is liberal, and augmentatively, as has terra-cotta, practically demonstrated the excellency of this material for fire-proofing.

It contains an article on concrete that is novel and thorough, defining the relative heat and conductive properties of concrete and terra-cotta; the reasons for many difficulties encountered in the use of concrete for floors; also a summary of the Denver Tests, so commonly referred to in matters of fire-proofing; extracts of the building laws as exacted by the city of Boston on fire-proofing matters; tables of the strength of steel beams, channels, and columns; strength of arches; also the United States Government test on the strength of porous terra-cotta; a most useful table to buyers, on the expense of the transportation of any article of fire-proofing to any point, and at any rate of freight.

It also contains a complete stock schedule of all the kinds, sizes, and weights of goods manufactured by this company, that is very useful to architects in laying out their iron work.

We take pleasure in calling attention of architects, builders, and owners to this catalogue, and believe they can find many answers to questions long in dispute, and a great deal of information.

It will be mailed free, by request to the Boston Fire-Proofing Company, Master Builders' Exchange, 166 Devonshire Street, Boston, Mass.

THE CUTLER MANUFACTURING COMPANY, of Rochester, N. Y., makers of the United States Mail Chute, now a familiar feature in the equipment of first-class hotels and office buildings, have secured a series of Mr. Claude Fayette Bragdon's admirable pen and ink sketches of minor Italian palaces, made on the spot in the summer of 1895 and not before published. The sketches will be issued quarterly, in four portfolios, each containing six plates, and will be sent to architects who are or have been in correspondence with the firm regarding their specialty. Architects should be familiar with the simple but somewhat exacting requirements which are a prerequisite to the installation of the Cutler Patent Mailing System, and a statement of them, with detail drawings and specifications of preparatory work, and estimates of cost, etc., will be promptly forwarded by the manufacturers, on request.

FOR two years it has been known that the Illinois Railroad was to build a subway to contain their tracks, extending from their depot to a distance of one and one half miles along the lake front, running parallel with Michigan Avenue, fronting on which are some of Chicago's finest hotels and public buildings.

It has been decided to construct this subway of concrete instead of granite masonry, and the contract for the cement has been awarded to the Alpha Portland Cement Company. Some forty thousand or fifty thousand barrels of cement will be used for this work during 1896.

This piece of work will start concrete construction in the West, and will be followed with much interest by engineers throughout the country.

IMAGINE what improvements in the art of brickmaking have taken place within the last few years! The Kulage Machine Works, St. Louis, Mo., state that with their machinery, the finest and best pressed front bricks can be put into the kiln ready for the fire at a total cost of less than one dollar per thousand bricks.

WASHINGTON MONUMENT.

As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,

College Avenue, St. Louis, Mo.

We construct and equip brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine — a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, COLLEGE AVE., ST. LOUIS, MO.

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Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

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In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

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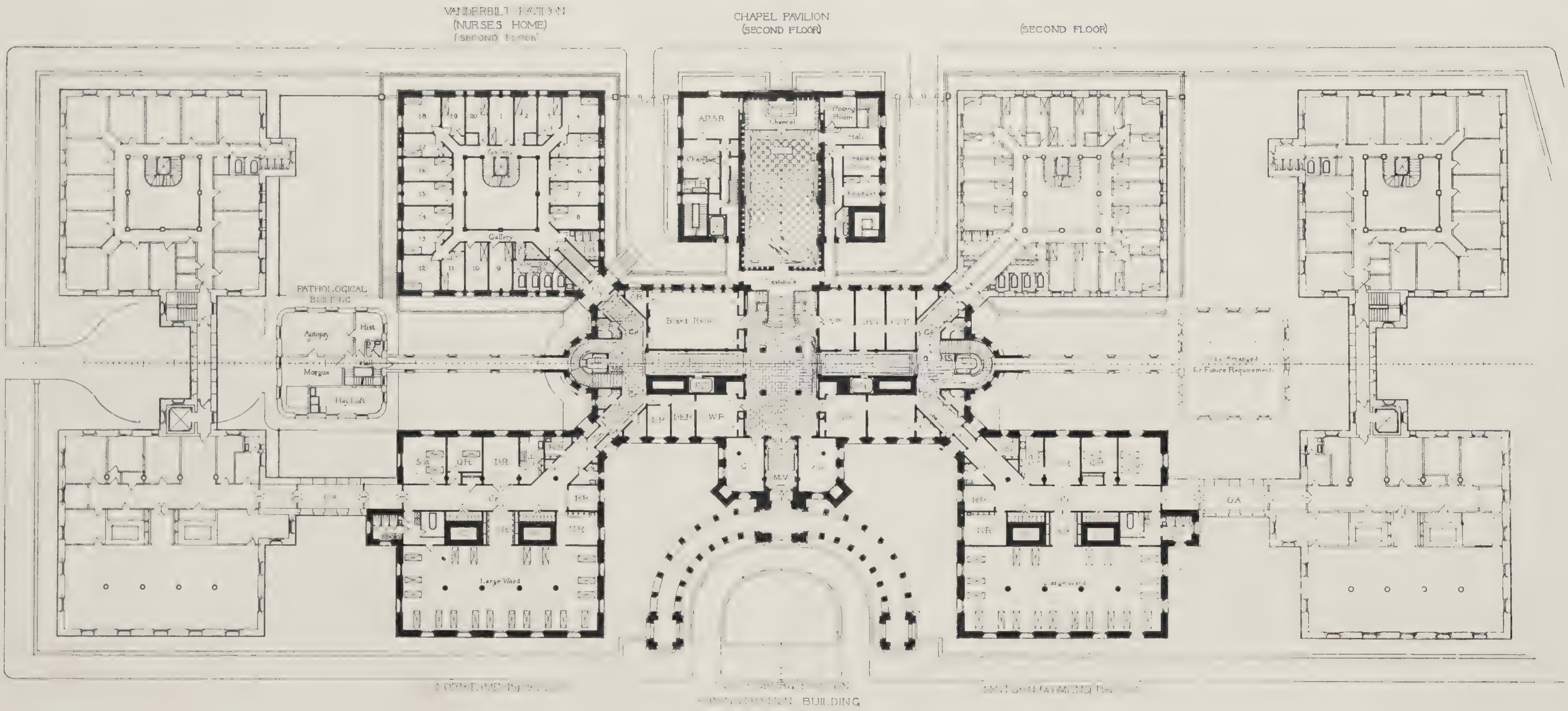
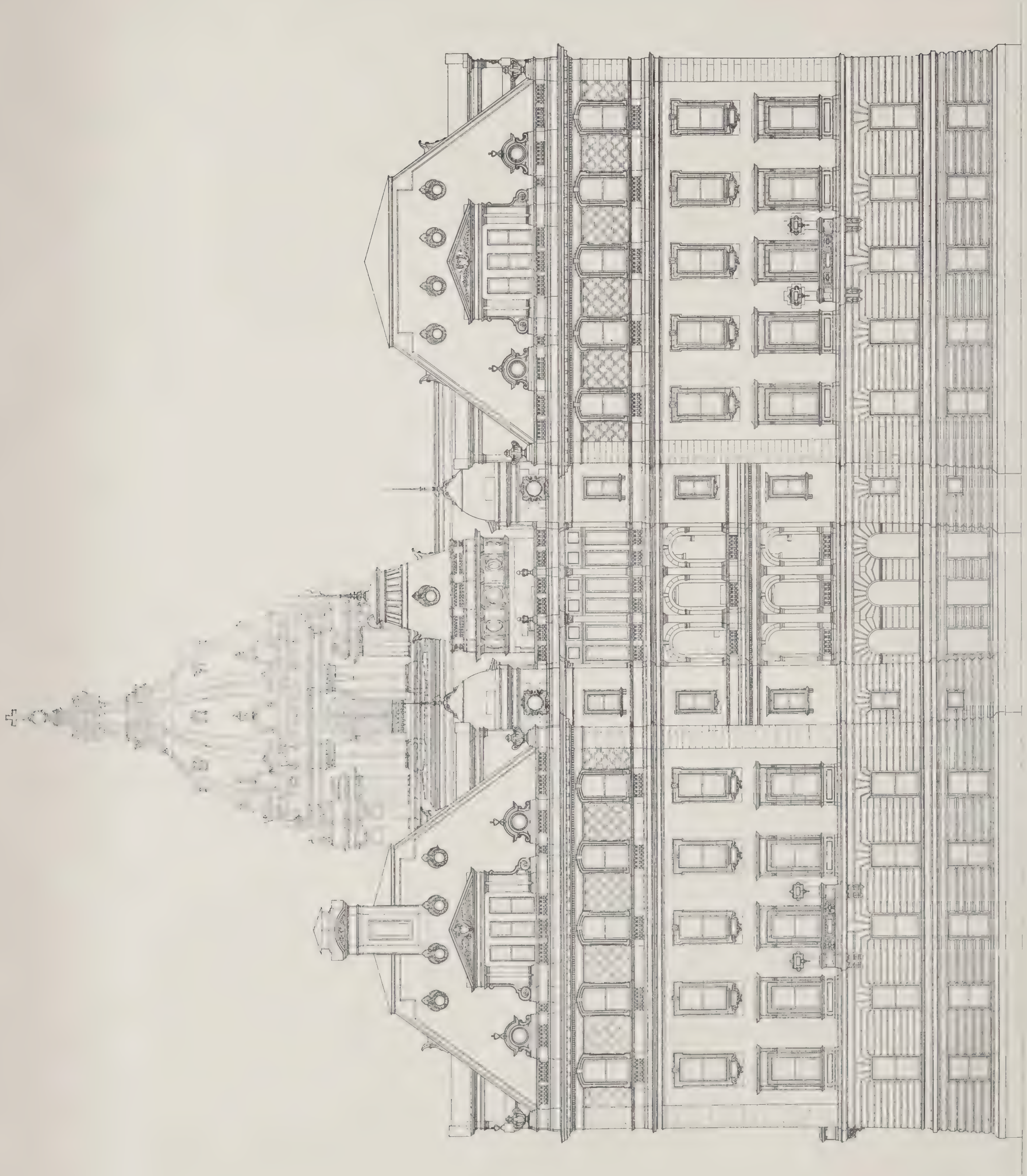
NEW YORK
ERNEST FLAGG, ARCHITECT



PLAN OF FIRST FLOOR.

A. S.	Air Shaft.
A. R.	Ante Room.
A. P. S. R.	Asst. Pastor and Superintendent's Room.
V. P.	Visitors' Parlor.
Cr.	Corridor.
C.	Cashier.
M. V.	Main Vestibule.
T. R.	Toilet Room.
R. R.	Reception Room.
V. W. R.	Visitors' Waiting Room.
W. R.	Waiting Room.
El.	Elevator.
M. S.	Main Stairs.
O. A.	Open Arcade.
D. E. R.	Doctors' Examining Room.
A. S.	Asst. Superintendent.
L. C.	Linen Closet.
P. C.	Patients' Closet.
D. R.	Dressing Room.
C. O.	Chaplain's Office.
Hist.	Histology.
P. S. O.	Pastor and Superintendent's Office.
St.	Stenographer.
C. R.	Committee Room.
N. R.	Nurses' Room.
O. H. N.	Office for Head Nurse.
O. H. K.	Office for Housekeeper.
Po. R.	Poultice Room.



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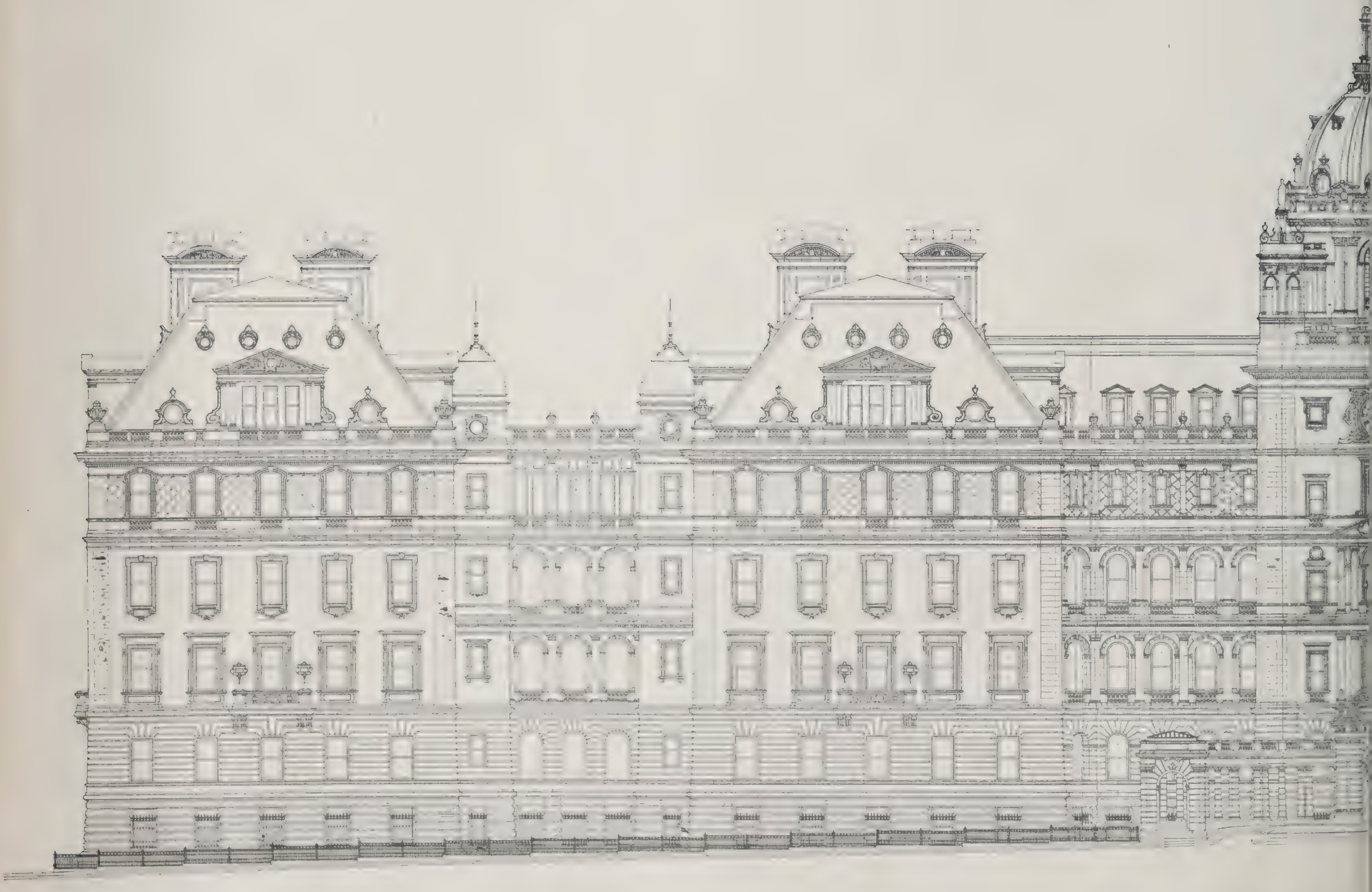
· Elevation of East End.

THE BRIC
VOL. 5. NO. 2.



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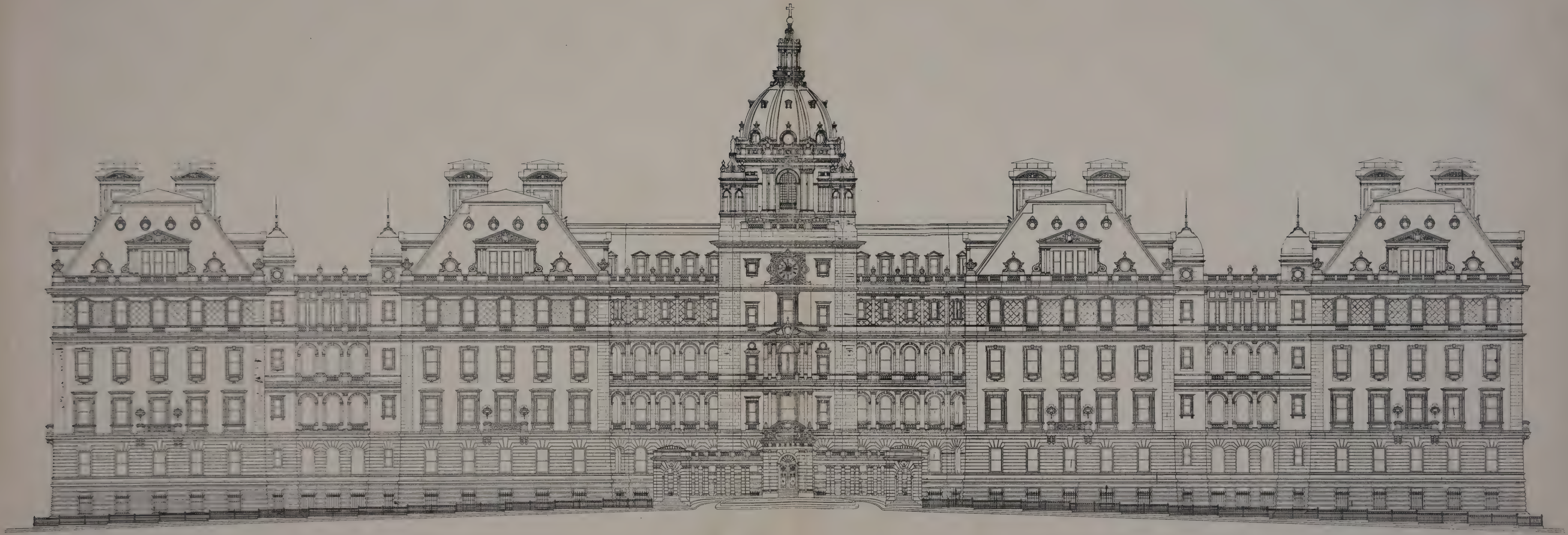
Front

ERNEST FL



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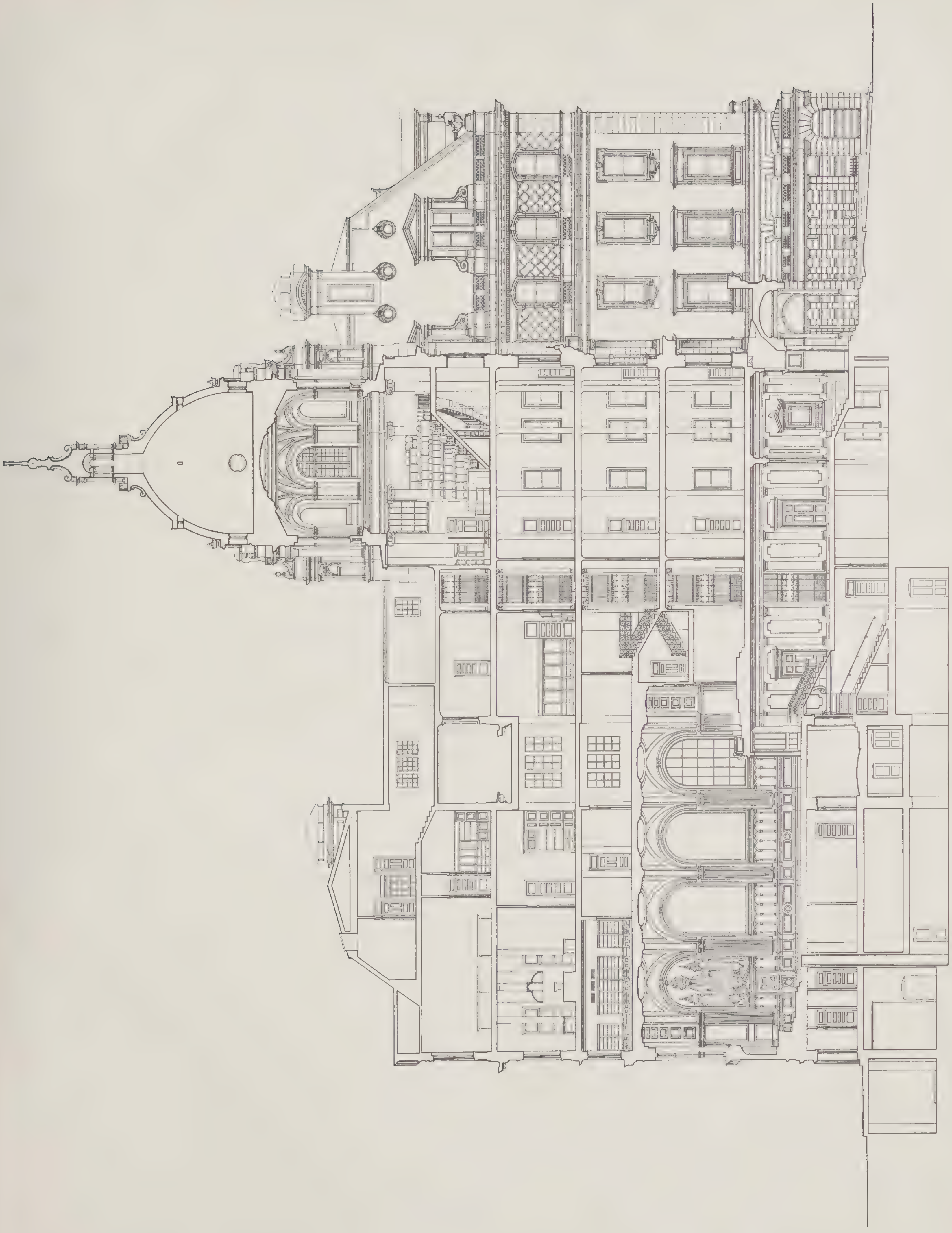
Front Elevation.

ERNEST FLAGG, Architect.



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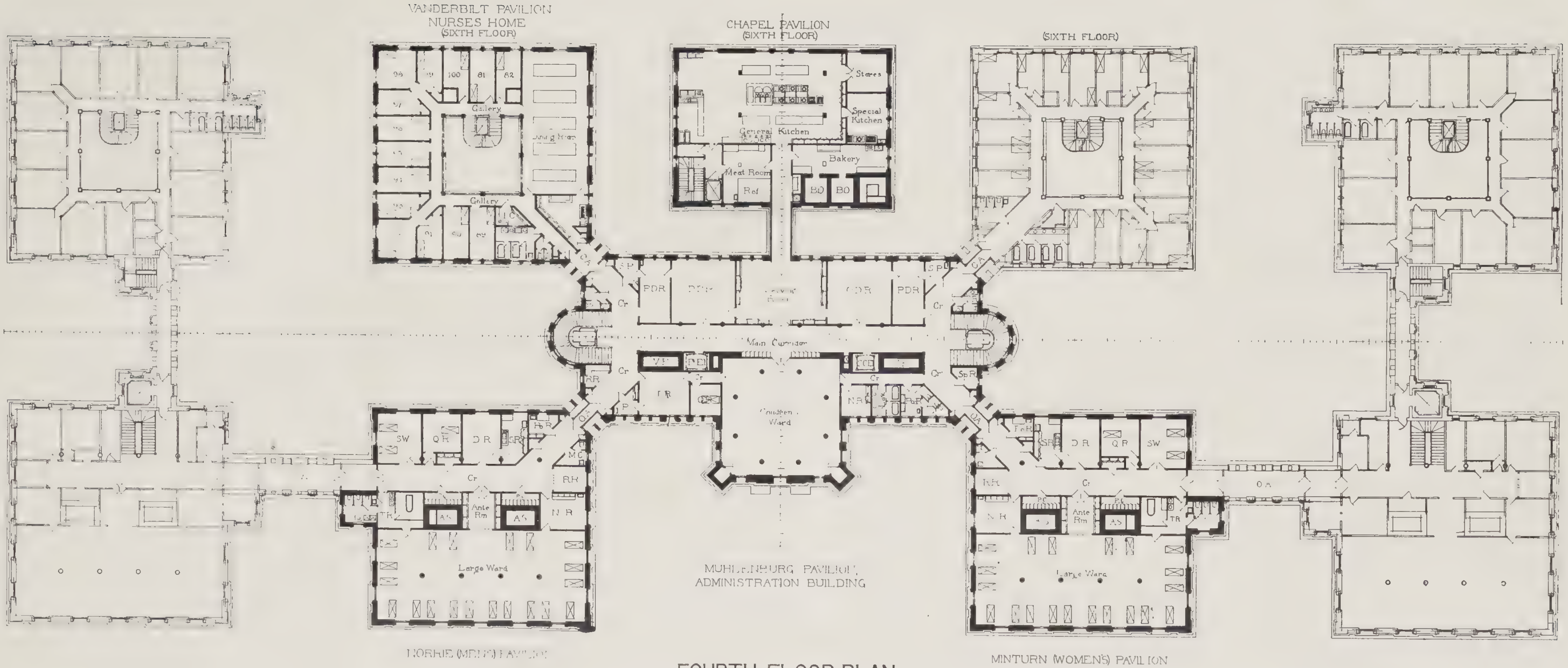
Sectional View.

SAINT LUKES HOSPITAL,

NEW YORK ERNEST FLAGG, ARCHITECT



FOURTH FLOOR PLAN.

A. S.	Air Shaft.
B. O.	Baker's Oven.
R. R.	Reception Room.
N. R.	Nurses' Room.
D. R.	Dining Room.
S. R.	Serving Room.
Po. R.	Poultice Room.
Q. R.	Quiet Room.
M. C.	Maids' Closet.
S. W.	Small Ward.
Cr.	Corridor.
Sp. R.	Splint Room.
T. R.	Toilet Room.
S. P.	Special Pantry.
P.	Pantry.
Lav.	Lavatory.
O. A.	Open Arcade.
L. C.	Linen Closet.
D. D. R.	Doctors' Dining Room.
O. D. R.	Officers' Dining Room.
P. D. R.	Private Dining Room.
S. C. El.	Soiled Clothes Elevator.
F. El.	Food Elevator.
V. F.	Ventilation Flue.
P. C.	Patients' Closet.

VOLVME
V
MARCH
1896
No. 3

THE
BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.
P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

TRAVELING SCHOLARSHIPS FOR BUILDERS.

WE hear a great deal about traveling scholarships and the value they are as means of raising the general artistic standard of attainment. There are scholarships which afford opportunities for painters, decorators, and architects; but so far as we know, there is not a single traveling endowment of any sort which undertakes to afford a varied practical education to a mechanic. It was formerly, and is still to a limited extent, the custom in Germany for every apprentice, before being admitted to practise his trade, to travel at least throughout his own country, observing the different methods and local uses of materials, and not thinking to call himself a full-fledged mechanic until he was familiar with more than the practise of his native town. It would be exceedingly desirable if some similar custom prevailed with us. While the United States is by no means as full of localisms as Germany or some of the older European countries, we are constantly reminded that the customs vary in the different States often to quite a considerable extent. For instance, in Boston the well-nigh universal practise in plastering is to cover the walls and ceilings with two coats of lime mortar, finished with a hand-troweled surface. Hardly anywhere else in the country does this custom obtain. In some cities shellac is used very largely for finishing woodwork; in other cities it is not used at all. But beyond mere questions of the use of material there is a deeper question of how to manage a building, the executive department, so to speak, of a builder's profession. This is very little understood in many of the eastern cities. We hear astonishing tales of the rapidity with which large commercial structures are erected in Chicago and other western cities, and are told that the common rule there is to allow only three days for the erection of all the structural work in a single story; and while some may maintain that work cannot be done well which is hurried to such an extreme extent and that the quality of work is often in inverse ratio to the speed, there are plenty of buildings in Chicago which have been erected on exceedingly short notice, and which are thoroughly first class in every respect. The secret of rapid construction is the avoidance of delays, and this is a point to which our eastern contractors, as a rule, do not give sufficient study. If a young man, before terminating his period of apprenticeship, would set aside a year to the study of the different building methods in vogue in, say, Boston, New York, Chicago, and St. Paul, working three or four months in each place with the best builders that he could find, giving his services for nothing, if necessary, we will venture to say that he would have his eyes opened to the fact that there are more ways than one to build a large building, and that while the ancestral traditions of the East deserve the fullest considerations and are in the direct line of mechanical excellence, the great West is full of the energy and push which helps a man to not only see what can be done, but to up and do it without waste of time or labor.

If to the eastern care and attention to details could be added the western push and executive ability, the combination ought to produce some pretty good results. We fancy that most builders are inclined to trust too much to the architect. While it is the latter's business to know what should be done, it does not follow that he knows how to do it. The architect studies the building from the point of view of the designer, and so long as it is built promptly and rightly, the process of execution interests him very little. On the other hand, the builder, while by no means oblivious to the artistic possibilities of the final result, is more concerned in the immediate management of the work, in getting it done quickly and avoiding unnecessary expenditure. There are a few of our younger builders who have found it well worth their while to study methods in other cities than their own, and who have spent a short apprenticeship under some of the Chicago builders with the result of vastly increasing their appreciation of how to handle the business of construction. While we are providing scholarships to educate artistic architects, to widen the scope of purely esthetic possibilities, and to bring the different sections of the country together on the lines of architectural development, we ought also to consider the development of the individual mechanic, to teach him that the whole country cannot be measured by the scope of his individual practise, that ways and means which, when half appreciated or viewed through the medium of local prejudices, seem to be irrational, may be the very best procedures for the circumstances under which they arise. One possible reason why traveling trade scholarships do not exist is undoubtedly because the vast majority of mechanics never expect to become master builders, whereas every young architect looks forward to an individual practise of his own, and consequently is all the time fitting himself for that practise. Most of our best builders have begun literally at the foot of the ladder, and have fought their way up by hard work and determined will rather than by the help of rich friends or a college education. To such the possibilities of a traveling practical experience would have meant a great deal in the earlier days; the individual mechanic, also, who never expects to become even a foreman, is worth more to himself and to the community after he has learned to observe, and to avoid ruts. A little knowledge is proverbially claimed to be a dangerous thing; but proverbs are not always right, and no matter how little experience a mason might have with the practise and materials of another city, he could not help but be benefited by knowing that other people do things right in other ways than what he has been accustomed to.

THE extended use during the past decade of the extremely light-colored bricks and terra-cottas has revealed qualities which, while by no means unknown before, are at present more unpleasantly manifest. It seems to be pretty well established that, with a few exceptions, all of our light-colored clay products are liable to be covered very shortly after exposure to the weather with a coating of a green fungus growth which is not only unsightly, but in some cases results disastrously to the material itself. Opinions differ widely as to the cause of this growth. We know that if clay of a very high refractive quality is used, and is not only thoroughly burned in the kiln, but is also fire flashed, the liability of fungus growth is reduced to a minimum. There are a few manufacturers who boldly assert that their bricks are warranted not to turn green. Others, with equal boldness, take the bull by the horn and state that they know their bricks will turn green and it cannot be helped. It has been claimed that this growth is due to the character of the mortar used in laying up the work, but that this is not the only cause is made apparent by the presence of a similar growth upon piles of bricks which are simply stacked in the yard. There are some preparations which seem to minimize the growth; but as a general thing, about the only remedy is to let a fungus develop itself, and after the work has been exposed a year or two, go over the surface with a dilute acid of some sort, washing it thoroughly and then applying a thin coat of oil. The fungus rarely manifests itself thereafter, though even this is not an absolute protection.

It goes without saying that this green disfigurement is anything but desirable, and architects and manufacturers would welcome any means of effectually preventing it. It has been observed that most of the English brick are not so affected, and a correspondent has made the statement that this is due to the fact that in England the practise is for the clay to be stacked in the yard and allowed to season in the open for several years before being worked up and burned. During this exposure the fungus growth, if developed at all, is washed away, and the resulting product appears to be entirely free from the green blotches. Some recent observations tend to confirm the belief that the fungus growth will not appear if the clay has been thus seasoned in the open. A dealer ordered some English bricks of a brand which in the past had never shown any signs of growth; but this particular lot, upon being built in the wall, speedily developed a most unsightly appearance. Inquiry at the home office in England revealed the fact that the yard had been greatly overcrowded with orders, and the particular delivery complained of had been made from clay which was not seasoned. An interesting series of experiments is shortly to be conducted with a view to determine whether the trouble is inherent in the clay or the mortar, or whether a tendency to fungus development can be stopped by weathering of the crude clay. These experiments will be watched with great interest and will be reported in this journal.

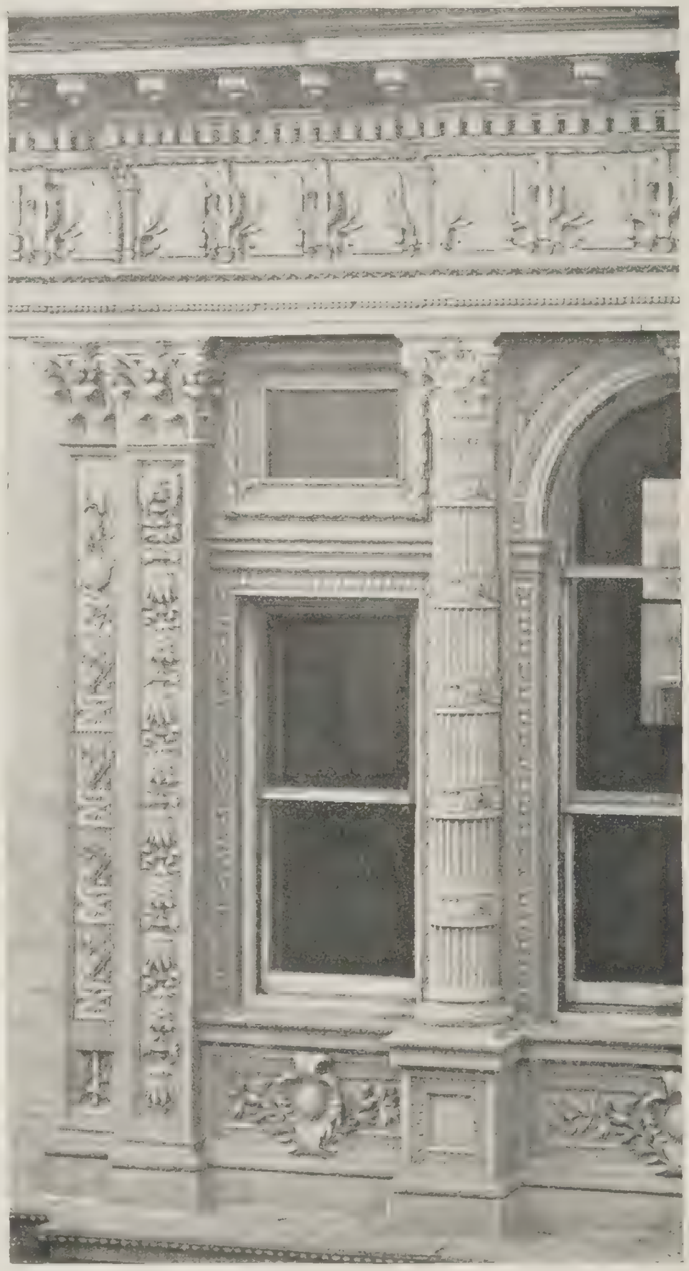
ILLUSTRATED ADVERTISEMENTS.

THE adjoining print is a portion of façade from the Eleventh District Court House, West 5th Street, of which Mr. John H. Duncan is the architect. A more general view of the upper stories of this building will be found on page xxiv.

On page iii is shown the immense department store of Siegel Cooper Company, Sixth Avenue, New York City, DeLemos & Cordes, architects. Its walls are faced with cream-white brick and terra-cotta.

On page xii is illustrated "The Breakers," Cornelius Vanderbilt's summer home, Newport, R. I., Richard M. Hunt, architect.

On page xvi, a residence on Drexel Boulevard, Chicago, H. H. Richards, architect.



THE ARCHITECT AND CONTRACTOR.

IN our Masons' Department, under the above heading, we begin this month a series of articles by Mr. Thomas A. Fox, the purpose of which will be to define, in a general way, the relations between the architect and the contractor and his employees; to consider from an impartial standpoint such matters as preliminary estimates, proposals, contracts, payments, and extras, and also working drawings and specifications and their interpretation. These papers will aim, above all, to give in a concise way such practical information as will enable the architect and contractor to practise their respective callings under the conditions and methods as are recognized to produce the best mutual results.

THE program of a very interesting competition will be announced in our April number.

ARCHITECT C. S. GERMAIN has opened an office in Curtis Block, at Butte, Montana, where he is desirous of receiving catalogues and samples from manufacturers.

THE ART OF BUILDING
AMONG THE ROMANS.

Translated from the French of AUGUSTE CHOISY
by Arthur J. Dillon.

PART II. CHAPTER II. (*Continued.*)

SECONDARY TYPES OF VAULTS OF CUT STONE.

UP to this point the study of cut stone vaults has included only the general principles of their construction and the applications of these to barrel vaults. I will now show how the results thus obtained were extended to the other common forms of vaults. In the first place, how vaults with horizontal intradoses, or keyed lintels, and flat arches were constructed.

One of the edifices where keyed lintels are most numerous is the amphitheater of Verona, and it is easily shown that a great number of these were built without the aid of centering.

These lintels consisted of three stones only, two skew-backs and a key (Pl. XXII., 3 and 4). Each skew-back was formed of a long stone set horizontally, which was in equilibrium on the piers, for its middle point was at the face of the pier, so that the overhanging portion was balanced by the rest; then the key was put into the interval between the two skew-backs, and as it was narrow, its weight would not cause them to over-balance.

Once the key was in place, the lintel was weighted with the masonry it was intended to carry; the key, being short, received only a small portion of it and had but a small thrust, while the skew-backs, on the contrary, weighted with a load proportional to their length, were firmly fixed in place and out of all serious danger of being thrust apart. To better resist the spreading tendency of the key, care was taken to place it only after the masonry was built up to the level of the top of the skew-backs. The inaccuracies in the construction show this in the most evident manner; the key, cut beforehand, was sometimes too long and sometimes too short to fit exactly into the space between the skew-backs. In one case (Fig. 3) it stops above its proper position; in the other (Fig. 4) it falls below it. If the rubble had not yet been laid about the skew-backs, this could easily have been remedied, in the one case by pushing the skew-backs apart, in the other by bringing them nearer together; but this was not done; the skew-backs remained as they had been set, and the keys were put in place as they came to hand, for to recut them would have been to stop the laying of the masonry whose top courses were already level with the top of the lintels. This would have meant the laying off of the entire force of masons; so no alteration was made. The appearance of the work is in some parts strangely irregular, but from the point of view of the art of building the method followed was irreproachable.

Evidently there was no necessity for any temporary support in building such a lintel; nevertheless, I do not think that the idea of economy is a sufficient explanation of the omission of the centering. The cost of the skew-backs, whose tails had to be large enough to balance the overhanging part, would exceed, or at least equal, the expense of a temporary support. But if one takes into account the position of the doors thus constructed, he will see that it was a greater advantage that led the builders to do away with all encumbering centering. The doors A, which were built without centering, were the only ones that gave access to the interior of the amphitheater, and it was no doubt through them that all the material was brought to the foot of the walls and then carried up the steps to the place it was to be used. It was, therefore, necessary to leave these doors always free and open. Moreover, their height was limited, and the smallest timber, reducing this in the least, would have been an embarrassment.

Hence the system is employed only where the doors are not at least two meters high; on the other hand, the lintels of all doors of great height such as B were built on centering, and are invariably composed of more than three keys. In view of the height of the openings, its reduction by the centerings was of no importance.

The method used for the low doors of the corridors at Verona was then advantageous only in one case, when the space was lacking for the centering. Nowhere, in fact, have I found this system used, except for doors where a constant circulation made the placing of the centerings difficult and their presence inconvenient; one of the doors (to-day walled up) in the ancient wall of Rome has exactly the same appearance, and, by a remarkable coincidence, the same methods and the same haste have given it the same irregular aspect as at Verona. The two skew-backs were set too far apart, and the key, cut beforehand, is hence much below where it should be; a precaution was taken here that was neglected at Verona, the lower part of the key which hung below the intrados being cut off,— but the error had none the less been made. In the one case, as in the other, the skew-backs had been balanced on the piers and the backing put in, and when they were firmly held by the rubble beyond all chance of separating, the key was put into place, completing the lintel.

It is to be noticed that the sides of the key make a very wide angle; this was to prevent slipping. Sometimes, even, to be more certain of preventing this, the keys were cut, as in Fig. 82; there are several of such lintels in the theater of Orange.

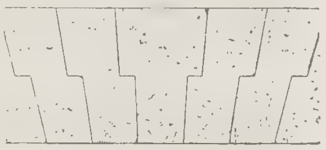


FIG. 82.

Akin to keyed lintels are the friezes built like discharging arches in order to protect the monolithic architraves.

The frieze of the monument, called the Temple of Jupiter Stator, is really a keyed lintel, built as a discharging arch over the stones of the architrave. It is composed of two skew-backs, centering over the columns, with a key between; but the architect took the wise precaution of leaving a small space between the bottom of the key and the top of the architrave, so that the pressure would not be directly transmitted. The same thing is found in the amphitheater of Pola; everywhere that a discharging arch is built over a monolithic lintel the architect has taken care to leave a small opening between them.[1]

Perhaps the most frequent types of vault, after the preceding ones, are those of the rampant and bias vaults. A rampant vault, if the slope is the least steep, is difficult to construct and of doubtful stability. The cutting of the ends, the junction of the vault with its supports, involve complicated forms and waste of stone; and, what is a more serious disadvantage, the rings of voussoirs tend to separate by slipping, from the effect of their own weight, so that it is necessary, to hold the courses of the vault on the slope which they tend to leave, either to interrupt it by horizontal parts or to have recourse to complicated and costly artifices in cutting the stone. It is evidently better to put aside the idea of a continuous vault, and replace it by a succession of arches echelloned at different levels (Plates XVIII. and XIX.). There is then no difficulty, either at the springing where the voussoirs of the vault must be fitted to the horizontal courses of the piers nor at the ends where the vault penetrates the vertical walls that terminate it. The arches at the ends differ in no way from the others; a single panel serves to lay out the entire construction, and the vault, whatever may be its slope, has all the stability of a vault whose generators are horizontal.

Such evident advantages should have fixed the choice of the Romans in favor of this system, but they did not use it equally at all

(1 See Stuart and Revett, The Antiquities of Athens, Vol. IV., chap. 1.)

epochs or at all points of the empire. The cut stone vaults which shelter the rampes of the Odeon of Athens are rampant vaults with smooth intradoses, and without doubt this exception is not unique.

But in our portion of the country, and especially during the last period of the empire, vaults consisting of a series of arches seem to have been generally used; there are many constructions analogous to that shown on Plate XVIII. beneath the soil of this part of the empire constituting a type in themselves, whose remains, lost for a long time, have been partially brought to light through the persevering researches of my friend, M. H. Sauvestre. I think there is no doubt that these monuments belong to ancient art; the absence of mortar in the joints, and especially the form of the plans, carries the date of their construction at least to the latter part of the imperial era. The staircases that lead to these singular hypogaea are invariably vaulted by a series of echelloned arches, sometimes consisting of a complete half circle, sometimes of only an arc; almost invariably, the sailliant angle of the arch is chamfered off so that the opening is larger, and hence the passage more commodious. There is nothing in this arrangement except what comes from the construction; and the form resulting from these well-thought-out combinations is at the same time very elegant and of an agreeable variety.[1]

The system used for rampant vaults was equally applicable to bias vaults. Was it applied? I do not know; and these are the only observations that I could collect on the subject of bias vaults. With the Romans, a bias vault was nothing more than a straight barrel vault, cut obliquely by the walls at the ends (Plate XX.); the beds are determined by radiating planes drawn through the axis of the vault and the joints by planes perpendicular to the same axis; the heliciodal system, which we adopt in constructing a very oblique vault, does not seem to have any equivalent in Roman architecture.

The extrados of a bias vault is a matter that needs very careful calculation. Imagine an oblique vault extradossed along a surface concentric to the intrados; the tympanum on this oblique extrados will tend to slip as on an inclined plane, its two halves tending to separate, the one moving forward, the other backward. A stepped extrados doing away with the sloping planes, offered gaurantees of durability that caused it to be adopted almost without exception. (Arco dei Pantani; oblique doors in the ancient wall of Rome, etc.)

What seem exceptions come to the support of the principle. The oblique door of Perugia (Plate XX.) has an extrados concentric with the intrados; but the Romans understood what they were accepting, and the expedient they resorted to to avoid the cause of deformation shows how grave they thought the danger arising from it. To put all chance of movement of the tympanums out of the question, they built between them and the oblique vault an intermediate vault, oblique within, but straight without. Its inner surface conformed with the vault which it enveloped, while its extrados gave a sure support to the walls it carried, similar to that of the tympanums of an ordinary barrel vault.

I have now to speak of the conoid and elliptical vaults, domes, and, finally, of groined vaults of regular large materials.

The cut stone work for vaults on converging piers or walls is remarkably simple. It seems natural, since the vault must have a conical form, to frankly adopt a conical intrados and to place the beds along the different generators of the cone. The Romans did this when the lack of parallelism between the supports was considerable, but usually the method was this: From the springing to a certain height A, the vault is the same as a barrel vault; above the course A the vault is also like a barrel vault, and the transition from the lower to the upper cylindrical parts is made by the course A. Only one of the intersections of the vault with the wall at the ends is circular, the curvature of the other changing suddenly at the height of A; but the lack of continuity in the curves is hardly noticeable.

In the arena of Arles, where a large number of vaults are constructed by this method, the courses A are contiguous to the key; or sometimes the entire difference is taken up in the key alone. The two halves of the vault were built without attention to the irregularities of the plan, and, when the summit was reached, the last blocks, which served as closures, were cut from templates taken on the spot.

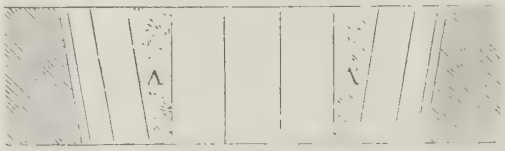


FIG. 83.

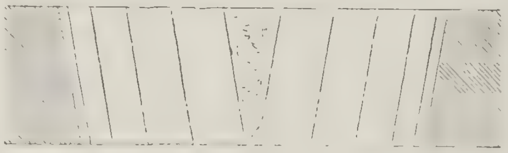


FIG. 83 bis.

(Fig. 83 bis.) Thanks to the expedient, the Romans could build with equal facility the cylindrical vaults, and the vaults on converging piers which give access to the radiating galleries of their amphitheaters.

I will limit myself to two remarks on the subject of spherical vaults.

First. Domes of cut stone belong almost exclusively to the Oriental countries of the empire (the circular temple at Balbek, the domes of large material of Haouran, etc.).

Second. Many of these domes cover square halls, and the transition from the rectangular form of the hall to the circular form of the dome is made, not by means of pendentives, but by means of slabs cutting off the corners of the hall. (See the work of M. de Vogue on "*La Syrie centrale.*")

I know of only one example of an elliptical vault,— the principal arch of the celebrated viaduct constructed by Augustus for the Via Flaminia, at the approaches to the Narni (Plate XXI.).[1] The vault was enormous, but only a few vestiges remain; and at first sight one might ask if the elliptical form that I give to it is not a gratuitous supposition. But it is only necessary to notice that the springings of the vault still exist, and that they are at very different levels. (See Plate XXI.) An elliptical vault or else a rampant *anse de panier* is evidently the only usual curve that could rest on these two piers of unequal height. Moreover, the road carried by the bridge of Narni has a very steep slope, and a rampant elliptical arch harmonizes better than any other form with the general character of steeply graded road. It is the form that leaves the least useless space, and therefore the one that is the most economical of material. But it may be asked if it is also the best in regard to stability. The arch has fallen, and it would be useful to know if this was due to a weakness in the form or to faults of construction. There can be no doubt on this point, in my belief; the cause of its ruin was the insufficiency of the foundations. The bridge was badly placed; floods caused washouts on the upstream side, the greater because the piers, having no breaks, produced considerable eddies. Little by little the piles leaned toward the side where the support was washed away and the two piers that supported the great arch participated unequally in the general movement; hence

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[1] From the point of view of the art of building, it would be very interesting to study this series of constructions in detail, for they are works of a school which is much more akin to those of the Oriental than of the Occidental parts of the empire; a welcome communication has brought to my knowledge the slabs carried on arches in these monuments, by means of tympanums, which seem copies of forms discovered in Syria. Even the plans of the tombs recall those of the Græco-Roman hypogaea of Haouran. But in order to keep to the facts that are the especial object of these studies, I will content myself with mentioning only the lintels built like those of the amphitheater of Verona, the unbonded vaults, built section by section (Plate XVIII.), and the certain unmistakable indications of a system of centering, which tradition has brought down to our days, and which consisted in the replacing of the frames by temporary walls, carrying the different courses of voussoirs by isolated purlins, either of wood or iron (see Plate XIX., the marks left by the purlins on the gables of a hall). I hope that these interesting details, which M. Sauvestre has kindly authorized me to sum up here, emphasizing them with drawings, will soon receive all the publicity that they deserve.

[1] *Procop., de Bello Gotthico*, Lib. I., cap. xvii.

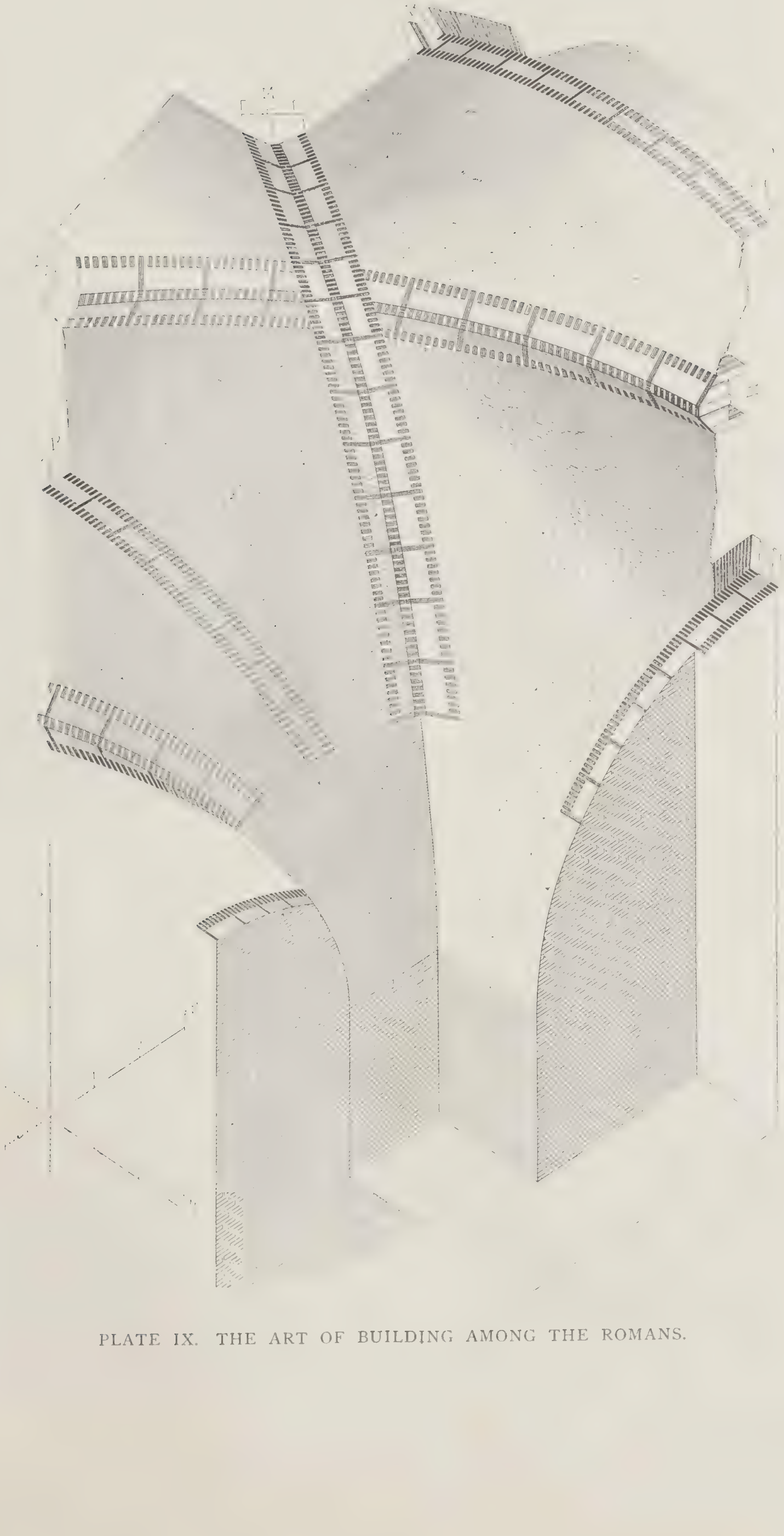

PLATE IX. THE ART OF BUILDING AMONG THE ROMANS.

the rupture of the arch. No other form would have stood any better, and the rampant arch of Narni remains one of the most remarkable conceptions of ancient architecture. Never had the problem of constructing a viaduct been approached more frankly or resolved in a more original or happy fashion.

I now come to groined vaults of cut stone. The briefest thing that can be said of them is that the Roman architects endeavored to avoid them. All the buildings they have left to us are witnesses of the efforts they made to keep free of them. Sometimes, as already said, they placed the vaults of intersecting galleries at different levels (Fig. 38); sometimes they profited by the type of vault adopted in the subterranean corridors at Arles; or they replaced the vaults by ceilings of slabs, whose spans were reduced by means of more or less ingenious corbels; or they even stopped the cut stone work vaults abruptly at the point where they crossed, and avoided the difficulties of the penetration by substituting rubble. This last instance is found in the temple of Janus Quadrifrons. (Plate VII., Fig. 2.)

The cautiousness that made them avoid penetrations in vaults of cut stone is easily explained. The voussoirs along the groins, being common to both vaults, have always a re-entrant angle; this made them more liable to fracture, and hence inspired the Romans with a just distrust. To this is due the extreme rarity of groined vaults of cut stone; I can cite none in all the monuments built at the best epochs in Italy; there are two to my knowledge in Greece, in the Odeon of Herod Atticus.

Alone, perhaps, in the whole series of ancient monuments, the hypogaea in the northern part of Gaules have vaults with lunettes, or even have groined vaults as a common element in their construction. The intersection of the barrel vaults on Plate XVIII. merits notice because of the simplicity of its construction. The penetration is only partial; the two vaults are of unequal span, and, in place of making a juncture between them, the builder contented himself with cutting the larger vault so as to allow the smaller to pass through it.

The cutting of the stone in the vault given on Plate XIX. should also be noticed; I give the keystone, in Fig. 84, which cut without waste of stone or reentrant angles, seems preferable to the form used in our days; it is reduced to an octagonal slab that presents a plane surface to each of the last voussoirs of the groins. But we have devoted enough time to types that are exceptional in Roman art.

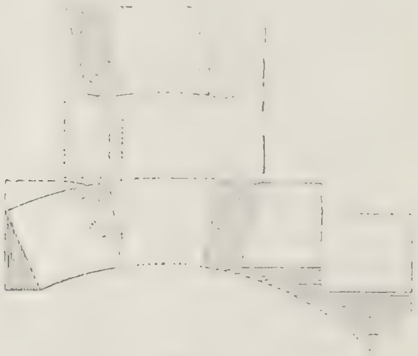

FIG. 84.

ORNAMENTAL BRICK WALKS.

WHEN two or three shades of brick are obtainable that are of the same hardness, so that they will wear uniformly, a very handsome walk can be laid following the same class of designs so successful in tile floors. When all these colors are not of the same hardness, by selecting the hardest for the center of the walk, which is to be kept plain, and laying the three colors to produce a border design, the wear on the sides will not be sufficient to seriously affect the walk. This especially applies to a walk from the house to the street. There is an infinite number of ways in which such a walk may be laid with the use of only two shades of brick. Such a walk, with a well-designed front wall, would be exceedingly effective in connection with a fine brick residence.—*British Brickbuilder.*

The Brick Architecture of Holland.

BY R. CLIPSTON STURGIS.

IN my previous articles I reviewed briefly the history of the Dutch people, and considered in some detail the brick architecture of their houses. I propose now to take up the brick-work of their public buildings, secular and ecclesiastical.

From what we have seen of the history of the Dutch, one would expect to find in their municipal and mercantile buildings the best expression of their art; for their cities, while not usurping the position of their finally united country, were yet, in a very true sense, the centers of all patriotic interest.

And, in fact, the town halls, markets, and public weigh houses are the most interesting and beautiful of the buildings of Holland, and are naturally the first objects of interest to the stranger.

They show the same careful sense of what is appropriate, and the same modest, and yet fit, use of ornament which I have remarked in their houses, but considerably more elaboration. In many cases, especially in South Holland and Flanders, brick was more or less discarded for the sake of the more magnificent effect to be obtained by the use of stone, but in the small towns the native brick was the material generally used.

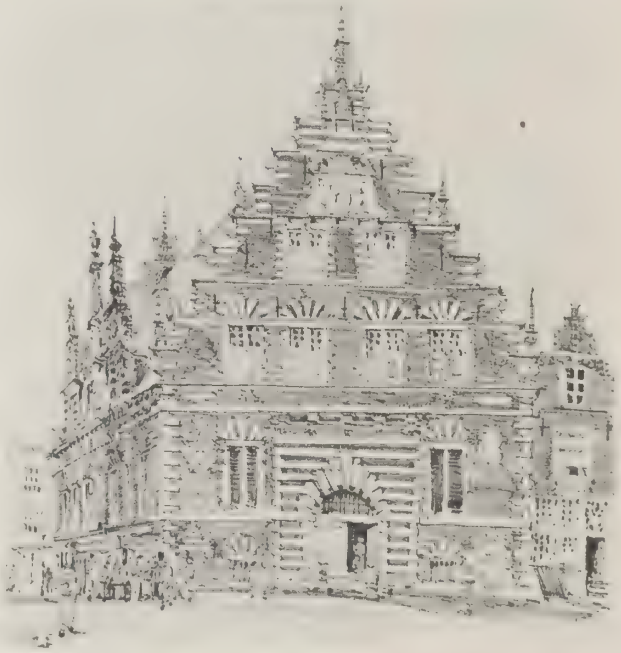

FIG. 1.

We note the same general features with which we have become familiar in the houses — stepped and ornamented gables, of simple proportions, and a nice use of molding and ornament, but added to this, in nearly all cases, a touch of dignity, which differentiates the municipal buildings from the dwellings, and marks their public use.

There are comparatively few buildings in Holland proper of the nature of the great Cloth Halls, such as that at Ypres and elsewhere in Flanders, for there was comparatively little manufacturing on a large scale north of Amsterdam, the population being largely occupied in agricultural pursuits; but in nearly every town we find produce markets and weigh houses, which, whether large or small, are invariably interesting.

In the market at Haarlem (Fig. 1) we have a very picturesque and probably, to most of us, a very familiar example of the somewhat florid and exaggerated Dutch style. I have illustrated it as showing what might be called the final limit of the picturesque this side of the grotesque. One feels that here one is close to the borderland, but not quite at a point where the picturesque element is out of due proportion to the common sense of architectural law. The gables are delightful in outline, so are the varied dormers, and the ornament is well studied and placed, and executed with vigorous intelligence. The brickwork is, however, a very distinctly subordinate part.

In the town hall at Leuwarden (Fig. 2) the brick plays a much more important part in the various molded shafts and archivolts. This is to me a wholly delightful example of the best Dutch work; a very rich, and yet very dignified façade, admirably expressive of its public character.

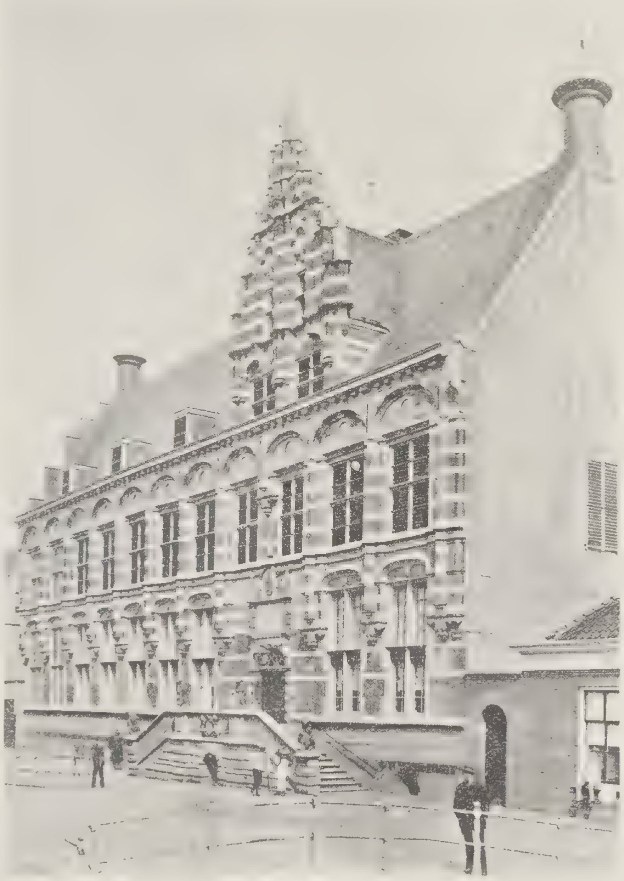

FIG. 2.

The weigh house at Amsterdam (Fig. 3) is a picturesque pile of brickwork, standing in the wide market-place and looking rather more like a medieval fortress than a building for peaceable mercantile occupation, but in those days the latter might have to serve for the former at any moment.

The town hall at Hoorn (Fig. 4) is of much the same character as the meat market at Haarlem, and is rather curious in its adaptation to an obtuse angle in the street. It is unfortunately no longer among the Dutch monuments, as it has been destroyed by fire since I was in Holland.

The list of public buildings might be almost indefinitely prolonged, and I hope that the mention of these few may lead to the more careful study of the public buildings of the Dutch; for they have not only filled their own country with beautiful examples, but have, through the Dutch Puritans, strongly influenced much of the architecture in the East.

In conclusion, I wish to look for a moment at the brick of ecclesiastical architecture. The Dutch were always a devoutpeople, having firmly rooted that love of family and home and that respect for marriage ties which lie at the root of reverence for holy things; but, like the English, they were never much in sympathy with Roman influences and domination, and in this, as in other matters, preferred independence. Their churches are numerous, but as churches are generally longer in building than secular structures, and as their more important ones were begun comparatively late in the Gothic or pre-reformation era, we are not surprised to find that a very great number of them are incomplete, and that many have, by over-zealous reformers, been stripped and whitewashed; so that where once there was at least the promise of great dignity and beauty, there is now but a sorry wreck, or a sad unfinished pile — dignified even in its incompleteness — to testify to the knowledge and ability of the masters who designed them. This is especially true of the great brick churches, for in the churches at Haarlem and Rotterdam we have fairly complete buildings, but of stone.

Utrecht (Fig. 5) boasts one of the most interesting church towers in Holland. It is, however, but a wreck, standing in the midst of the ruins of the church to which it belonged, and the tower itself has been so shaken at various times that its long windows have been partially bricked up to save its life — but it surely shows in its quiet dignity of outline how little dependent the true architect need be on his material.

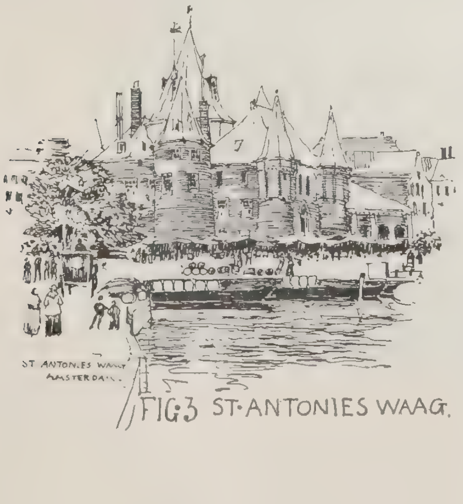

FIG 3 ST·ANTONIES WAAG.

In nowise were those architects of the Lowlands hampered by the fact that they had but common brick at their command. With this simple material, actuated by the self-same spirit which produced the great French and English cathedrals, they designed; and, just as at Siena one is impressed with the magnificence of the scheme which an ambitious people planned, so one cannot but feel the influence of the enthusiasm which, in unsettled and troublous times, laid the foundation for such a great tower as that at Wijkbijdurstede (Fig. 6), a small and unimportant town, or at Dordrecht (Fig. 7.)

The church at Dordrecht is chiefly famous for its stalls and carving inside, but the tower is simple and massive, and even in its unfinished state, interesting.

Wijkbijdurstede is rather a jaw-breaker of a name, and especially for a little town. Wijk. is the shortened form, and means a ward or parish. It is not far from Utrecht, but the tower does not seem to have been in any way modeled on that of the larger town. It was evidently intended to carry a tower gradually changing to octagonal, and decreasing in size, similar to the great tower at Antwerp, and it would be interesting to see how they would have treated such a delicate structure in brick.

At Brielle, on the mouth of the Maas, near Rotterdam, is another of these grand towers (Fig. 8). There is a tremendous dignity in the massive buttresses, in the long, simple lines of the lancet shaped

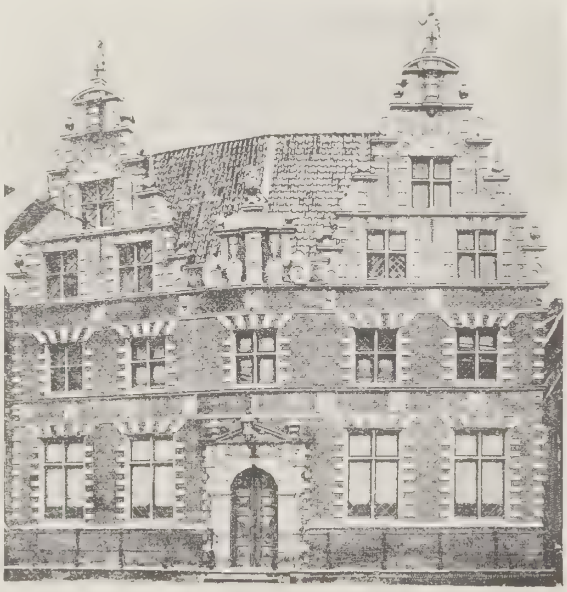

FIG. 4.

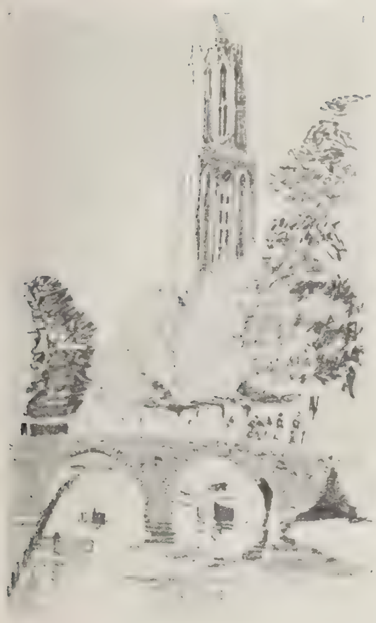

FIG. 5.

openings, and a tempting field for the imagination in constructing the superstructure which such a building was designed to carry.[1]

At Noordwijk, not far from the famous Scheveningen beach, on the sea, is a plain, square tower (Fig. 9), built exclusively of brick, very simple and very impressive, intended, perhaps, to stand the savage onslaught of the North Sea winds, having neither tracery nor moldings, neither turrets nor finials, to be injured by boisterous weather.

For the illustrations of Leeuwarden, Brielle, and Noordwijk, I am indebted to the courtesy of Mr. Cuypers, who lent me these photographs from his private collection, and there was also with them the superb tower No. 10 with which I am, unfortunately, not familiar; but it is too fine in proportion and detail to omit from my illustrations, and it shows also some excellent modern work of restoration, probably due to Mr. Cuypers, who has done much to restore and rebuild the architectural monuments of Holland, as well as to add to them by his new work.

I wish also to express my thanks to Mr. Jacques van Straaten, Jr., for many years a coworker with me in Boston and now practising architecture in Utrecht, for his kindness in collecting and forwarding to me the photographs, some of which I have used as illustrations.

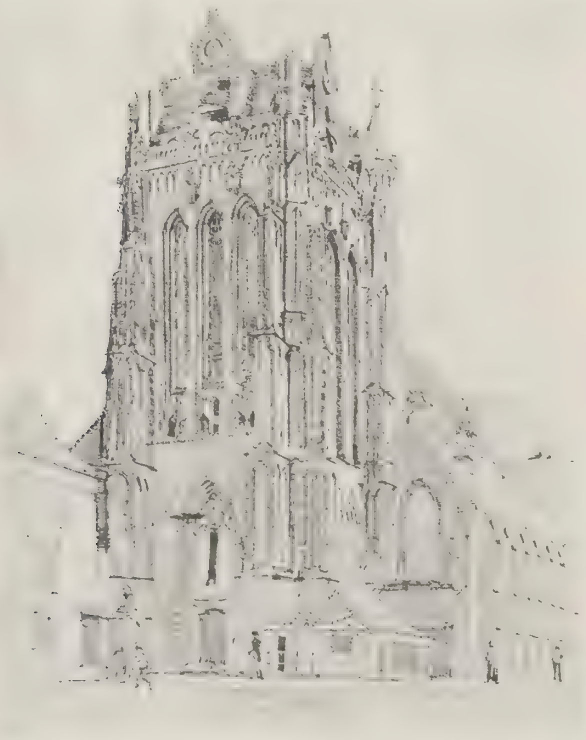

FIG. 6.

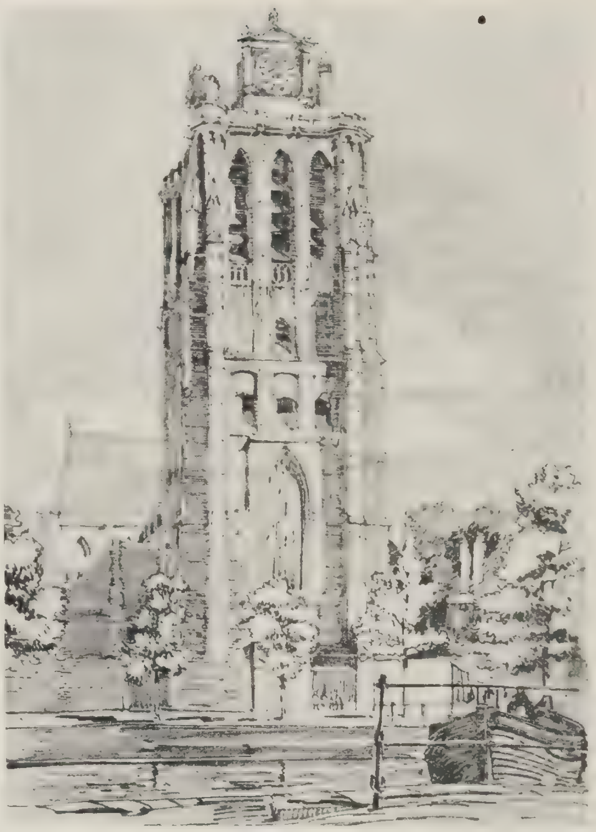

FIG. 7.

IN discussing a paper recently read before the Institution of British Architects by one of its members, the *British Brickbuilder* says:—

"It furnishes another illustration of the fact that, in urging a pet theory, your up-to-date paper writer is often unmindful of the consequences in other directions. The author, in the course of his remarks, said it was essential, except during the winter months, that bricks should be well wetted before being laid. Now, the author must be perfectly well aware that such a process must render the average brick much heavier than when in the dry state. Does he

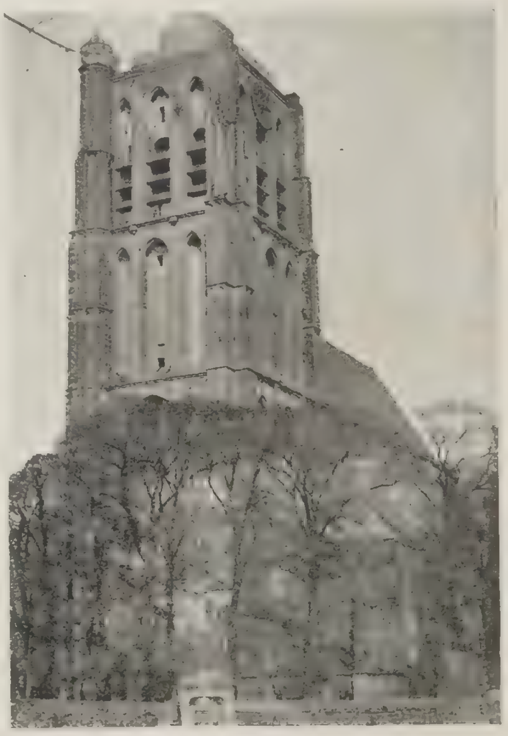

FIG. 8.

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[1] It was this town of Brielle which was the first to oust Alva, and caused the pun about Alva's having lost his specs (Dutch *brielle*).

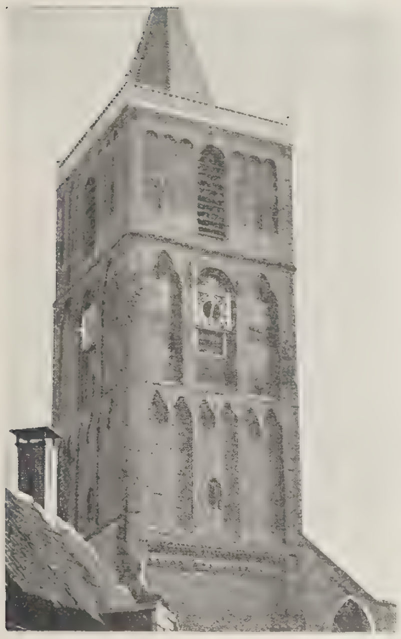


FIG. 9.

know that one of the principal reasons why bricks are not made of a larger size is because they become too heavy to handle in consequence? Does he believe that builders in these cutting times will care to increase the cost of the work by the treatment suggested? For every additional work, however small, is cumulative in such cases, and must, in consequence, find but little favor with the constructor. He furnishes a most excellent reason why bricks are not ordinarily wetted before being laid — for he mentions the fact that wet bricks make bricklayers' fingers sore, and that, we should think, would practically dispose of the matter. Again, he says that they should not be wetted during the winter months. The reason, presumably, is because of the deleterious effects of frost, and the exceedingly cold work the bricklayer would find it in handling bricks with the thermometer below the freezing point. After this, we shall expect the County Council, who is expert at making new regulations, to get a clause inserted in the new Building Act to the effect that all bricks are to be used wet, except when the thermometer is below a certain specified temperature."

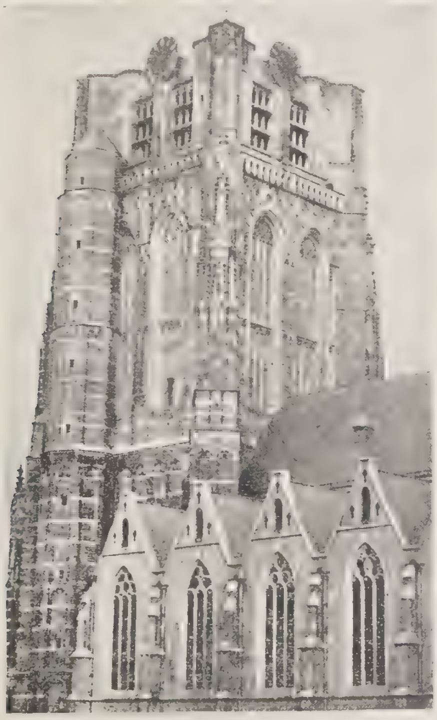


FIG. 10.

The reading of such a paper is a step in the right direction, for the "classes and the masses" have too long been estranged, to their own detriment. Architects are too apt to lay undue stress upon the professionalism of their calling, and forget that practical men can teach them things of which their own men of light and leading are entirely ignorant.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

ELECTRIC WIRING OF BUILDINGS.

BY F. E. CABOT.—(*Concluded.*)

THE term "electrolysis" has been popularly known as occurring in electroplating and in the process of separating metals, especially copper, from their ores. The public has also become somewhat familiar with the word through its use in the newspapers as describing the causes of injury to gas and water pipes by the current used as motive power for street railways. In these forms the word has become familiar as the result of large amounts of electrical energy, and it is probable that it is usually thought of as only existing with or as a result of such large amounts of current. Such an idea is, however, entirely erroneous; this action takes place as surely with small amounts of current and with low pressures as with the power of the dynamos of a large street railway to produce it. It, however, exists only in proportion to the amount of energy producing it, and, in fact, is so accurate a measure of this energy that it is often used for determining with certainty the amount of power in a given electrical circuit.

Now, while this manifestation of energy is in most places slight, it is, nevertheless, continuous, and, like the dropping of water on stone, will eventually force itself into notice by its results, and in connection with electric currents for lighting and power, these results are apt to be annoying and are sometimes disastrous.

All or nearly all circuits which supply current from central stations are insulated to a greater or less extent in electrical connection with the earth; to use the technical phrase, they are more or less heavily "grounded," and therefore, whenever any part of the wires for such currents in a building with metal frames are connected by moisture or otherwise with these metal frames, or in other buildings with the gas, water, or sewer pipes, a certain amount of the current is deflected from its proper course and passes through these metallic frames or pipes to the earth, and thence to the other point or points where the circuit is "grounded." Now, suppose that this connection is made by moisture and that this moisture continues from condensation, for instance, for months. As has been noted in the first part of this article, electrolysis is sure to take place; bit by bit the conducting wire is dissolved, and finally it is lessened in size at the point to such an extent that it is no longer able to carry the current for which it was installed. This condition may exist for a long time without attracting attention, for the maximum amount of current is not often required; but sooner or later the occasion comes, and the flow of current is forced through the weakened spot.

But one result can occur; the weakness is shown by the heating of the wire at this point, and it is not unlikely that this may be carried to a temperature which will set fire to the insulating covering of the wire, for all water-proof insulating materials sufficiently plastic to be applied to a wire are inflammable. It is probable that no serious fire will occur if the building is, as we have assumed, of masonry and iron construction, but a disagreeable smoke will probably find its way into the rooms, and the particular circuit affected will be rendered useless. It will probably be said that such circuits will be provided with "safety cutouts," which should melt and cut off the current before undue heating takes place; but it must be remembered that such devices are necessarily proportioned to the *normal* size of the wire they are intended to protect, and that the cause of this trouble is not an abnormal amount of current flow, but a diminution of the wire at a given point below its proper size.

In another way, also, electrolysis is likely to occasion trouble in buildings of masonry; this comes from the sodium contained in most, if not all, forms of cement mortar. Where moisture passes through or over the surface of this material it dissolves a certain amount of sodic compounds, and, should this solution come in contact with a current-carrying wire, so as to divert part of the current to the ground, electrolysis separates the compounds, which recombine with the moisture to form sodic hydrate commonly known as caustic soda, or else deposits the sodium in metallic form. Now, caustic soda, as is well known, attacks all forms of vegetable fiber and is an excellent solvent for the tarry substances often used as a finish on the outside of an insulated wire. In this way the insulation is either removed or injured to such an extent as to be of no value, and the electrolytic action on the copper noted above is very likely to follow. Moreover, should metallic sodium be deposited, there is always an added chance of fire occurring, for, as well known, metallic sodium combines so rapidly with water as to set fire to the hydrogen gas set free in the process of combination. All of these things have actually taken place under working conditions and in actual practise, but so far as is known no serious fire loss has occurred. The injury to the insulating covering of the wire has, however, in more than one case, been sufficient to make extensive repairs necessary, and the reduction in size of the copper conductor has also occasioned some trouble. These difficulties are, therefore, those for which remedies are particularly needed, and to which attention should be directed.

Before considering what means should be taken to avoid these difficulties, let us for a moment notice the injuries likely to result from the other point alluded to in the first part of this article, the use of quick-drying plaster.

The opponents of these materials have often pointed to injurious results obtained from their use, and lest there be any misunderstanding in regard to the position taken in this article, it should be stated now, that after much study and consideration of the matter, the writer finds good reason to believe that with proper care and such use as the makers of these materials recommend, no injury or defect is likely to occur. Such difficulties as have appeared have been from misuse of the materials and from the desire, unfortunately too common in construction in this country, to save a few days or even weeks in the completion of a building. The use of quick-drying plaster has made it possible to save time in this part of the work and has, moreover, given us a very hard and desirable finish for walls; but because such materials can be forced to remain in position, with only a day or two in which to harden, shall we therefore erect, plaster, smooth-coat, and *paint* a partition within ten days? The paint, if it does not peel off, must retain in the plaster all the moisture which should be given a reasonable time to escape, and we may be sure that if the moisture is forced to remain, it will expend a part, at least, of its energy in corrosion of any oxidizable metal which it can reach. There is good reason for believing that much of the "destruction" of "brass-armored" conduit of which so much has been made during the last year or two has been caused in exactly this way, and would never have occurred had a proper time been allowed for the moisture in the plaster to escape. So, also, much has been said of unsatisfactory results from brass-armored conduit laid in cement in floors, but careful examination will show that these effects usually, if not always, occur under tile floors where the water used in cleaning soaks through the cracks between the tiles and keeps the material beneath constantly damp.

If we recur to the general question of injury to conduits and conductors by materials of construction, we shall see that the most common forms of trouble occur only where moisture is present, and the natural way out of such a difficulty is to arrange all the circuits with special reference to freedom from dampness if possible, and if this is not possible, then to make special arrangements for such parts of the work as from their nature are particularly susceptible.

All cutouts, switches, and branch connections are likely to have bare metallic parts mounted on porcelain or similar material, and such apparatus should *never* be placed where moisture can reach it. The fact that the metal is mounted on an insulating material does not prevent electrolysis if the moisture has an opportunity to accumulate on its surface, although, of course, the amount of current passing off in this way is slight, and the electrolytic effect is correspondingly small. No reasonable excuse can be given for a failure to arrange this part of the circuit property, for it is a vital part and does not occupy much space. In most buildings, if the danger from moisture is kept in mind, the whole circuit can be so placed that moisture will find neither a ready entrance nor a place to stay except when wires must be put under tile floors. When it is necessary to locate circuits in such places, excellent results may be secured by placing the whole in a wooden trough and filling in with hot tar before the tiling is put on.

Care should be also taken that all conduits or ducts are not so placed as to carry currents of warm air, as under such circumstances condensation is sure to take place. If such currents cannot be prevented, then special care should be taken to prevent accumulation of moisture by giving proper methods of drainage.

In the use of materials, of course, the only safe rule is to use the best always, and in this connection it may be well to call attention to the fact that rubber is much less susceptible to injury from caustic soda than the tarry compounds used in "weather-proof" coverings, and, consequently, withstands this attack as well as the ordinary effects of dampness.

The heavy iron-covered conduit is more durable than the brass-covered form, and will suffer less from corrosion.

Above all things comes the advantages of first-rate workmanship, and here again the question of time must enter into the result, and only by general consent of all concerned to allow sufficient time can satisfactory results be obtained.

If the American people as a whole could realize the number of years wasted by lack of time in building construction alone, the pressure to complete a piece of work in a few days would diminish and the results would correspond to those now obtained by quickness of thought through which the nation has pushed so far to the front. We should then have buildings of which we could be proud for the perfection of construction as well as for the skill and development in methods of construction, and American cities would have a less ephemeral existence.

EXPERT FIRE-PROOFING ENGINEER.

EDITOR OF THE BRICKBUILDER.

Dear Sir: — It is a little surprising that, although we are living in an age of specialists, fire-proofing as a science should find no specially recognized representatives. To be sure, it is a very recent science; for although buildings have been erected from time immemorial which were practicably incombustible, the modern fire-proof constructions have been evolved almost within the past decade, and certainly within the present generation. General Sooysmith is a recognized authority on foundation; the late General Gillmore was equally acknowledged on the line of cements and mortars. We have experts in sanitary matters and on all forms of steel construction, but when a specially complicated question of fire-proof construction arises there seems to be no one who is accepted as being the best referee on the subject. Mr. P. B. Wight, who has contributed probably as much as any one else to the creation of specialized fire-proofing products, has for years been identified with one of the manufacturing companies, a connection which would naturally place him out of the line of general consultation; and there seems to be no one whose experience, education, and natural fitness would make him preeminently a consulting engineer on fire-proof work. It is believed that there is a possible field for some bright, thoroughly trained young man to make a reputation for himself in this direction and at the same time be of immense service to contractors, engineers, and architects generally. We are quite ready to welcome the electrical engineer, the sanitary engineer, and the expert on foundations or steel work. An expert fire-proofing engineer would be equally desirable, and ought not only to find ready employment for his talents, but might also be able to make fire-proofing more nearly an exact science, which it is not at present.—*B. S. P., Chicago, Ill.*

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Continued.*)

THE CHEMISTRY OF CEMENTS.

ALTHOUGH the formulæ which are headed by silica are all that are really essential for a correct determination of the percentages of silicates, yet for the sake of simplifying the work, and rendering it an easy task to calculate the percentages of silicates or active setting matter, and thus to readily determine the correct amount as well as the kind of inert substances in a cement, the other formulæ have been given.

To determine which formula to use, it is only necessary to note which of the component parts is the lesser in any given analysis, then use the formula which is headed by that ingredient, care being taken to note the number of bases under consideration, as the ratio is not the same for all classes of silicates.

To illustrate the use to which these formulæ may be put, a few of such numbers in the table of analyses as will best serve the purpose of employing the greatest number of the formulæ will be selected.

ANALYZATION OF ANALYSES.

No.	1		2		3		4		5
Silica	24.33	—	6.58	=	17.75	—	17.75	=	00.00
Alumina	3.73	—	3.73	=	0.00	—	0.00	=	0.00
Lime	71.94	–	12.27	=	59.67		33.08	—	26.59
Totals	100.00		22.58				50.83		26.59

Bisilicate of lime and alumina	22.58
Silicate of lime	50.83
Free uncombined lime	26.59
Total	100.00

Column No. 1 gives the analysis as shown in No. 2 of the table of analyses.

Column No. 2 shows the percentage of bisilicates contained in the cement, which is obtained by using the formula I, in which it will be seen that 1.000 alumina combines with 1.764 silica.

Therefore alumina 3.73 × 1.764 = 6.58 silica, and by the same formula it will be seen that 1.000 alumina in a bisilicate is combined with lime 3.289, therefore 3.73 × 3.289 = 12.27 lime.

The new column No. 2 is now formed by placing the three constituents opposite their respective names, and the footing shows that the total percentage of bisilicate of lime and alumina is 22.58, which being subtracted from column No. 1 leaves silica 17.75 and lime 59.67, column No. 3.

Now by referring to formula A, it will be found that 1.000 silica combines with 1.864 lime, therefore silica 17.75 × 1.864 = 33.08 lime.

This gives silicate of lime 50.83 as found in column No. 4. Column No. 5 shows the amount of uncombined material, which in this case is 26.59 free lime.

For a second illustration No. 5 of the table of analyses will be used.

No.	1	2	3
Silica	28.14	28.14	30.73
Alumina	9.10	9.10	9.94
Oxide of iron	3.20		
Lime	53.34	53.34	58.24
Magnesia	1.00	1.00	1.09
Potash and soda	2.80		
Loss	2.42		
Totals	100.00	91.58	100.00

The first column contains the analysis of No. 5 in full. The second column contains such numbers of the first as constitute the essential constituents or active setting matter of an hydraulic cement, and is reduced to hundreds, as shown in the third column, by dividing each number by the total 91.58, as, for instance, silica 28.14 ÷ 91.58 = 30.73, which is the percentage of the silica, as shown in the third column, along with the percentages of alumina, lime, and magnesia, which in the following table will be found under No. 1.

No.	1		2		3		4		5		6		7
Silica	30.73	—	1.64	=	29.09	—	15.90	=	13.19	—	13.19	=	0.00
Lime	58.24	—	3.05	=	55.19	—	29.65	=	25.54	—	24.58	=	0.96
Magnesia	1.09	—	1.09	=	0.00	—	0.00	=	0.00	—	0.00	=	0.00
Alumina	9.94	—	.93	=	9.01	—	9.01	=	0.00	—	0.00	=	0.00
Totals	100.00		6.71				54.56				37.77		0.96

Trisilicate of lime, magnesia, and alumina	6.71	
Bisilicate of lime and alumina	54.56	
Silicate of lime	37.77	
		= 99.04
Uncombined base (lime)		0.96
Totals		100.00

There being three bases in this cement, it is evident that the first formulæ to be used will be found under the head of trisilicates, and the magnesia being the lesser in quantity, formula O is used as follows: —

Magnesia 1.09 × 1.503 = 1.64 silica, which is placed in column 2 opposite silica.

Again, magnesia 1.09 × 2.803 = 3.05 lime, which is placed in column 2 opposite lime.

And lastly, magnesia 1.09 × .852 = .93 alumina, which being placed in column 2 opposite alumina, and the total magnesia also being placed in column 2, completes the column, the footing of which shows that the total amount of trisilicate in the cement is 6.71.

By subtracting column 2 from column 1, the remainder is shown in column 3, and as there are now but two bases, lime and alumina, in this column, it is clear that the proper formula will be found under the head of bisilicate of lime and alumina, and as the alumina is the lesser in quantity, formula I is used in the same manner as in the previous analyzation, which in this analysis forms column 4, showing 54.56 bisilicate of lime and alumina. The remainder, in column 5, shows but one base, and as it is slightly in excess of the remaining silica, formula A is used, the same as in the previous table, resulting in column 6, which shows 37.77 silicate of lime.

Column 7 exhibits the total remaining uncombined matter in the cement, which is found to be less than one per cent.

(*To be continued.*)

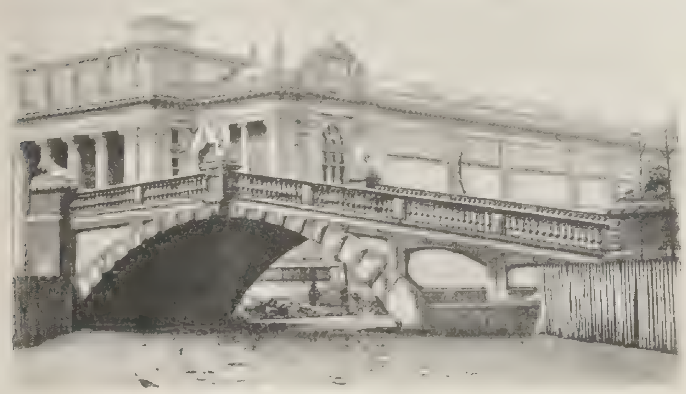
GERMAN CEMENT INDUSTRY.

THERE are about sixty-three cement works in the whole of Germany. The Rhine is the principal center for this manufacture, but in the neighborhood of Hamburg there are three or four in operation for the production of the article. The annual production of Germany amounts to nearly 11,000,000 bbls. The largest customers for this article of transatlantic countries are the United States, Brazil, Chile, and Venezuela. The exportation to Great Britain and British possessions is comparatively small. The following table gives approximately the quantity and value exported to America: United States, 1,386,872 cwt., £168,000; Brazil, 446,340 cwt., £40,200; Chile, 131,000 cwt., £13,000; Venezuela, 103,000 cwt., £9,800.— *Engineering and Mining Journal.*

CONCRETE BRIDGE AT THE ANTWERP EXHIBITION.

THOUGH concrete bridges are no longer a novelty, there is scarcely an instance of such a bridge having been built without the use of iron construction.

In 1894, North's Portland Cement Works Company constructed an *all cement* bridge at the Antwerp exhibition. It serves to cross the Rue des Sculpteurs, which had to be left open for traffic, and leads from the garden in front of the Industrial Hall to the Congo Section, which is situated between the Machinery Hall and the picture galleries. The arch is 6 ft. 6¾ ins. thick at the springing, and only 1 ft. 7¾ ins. at the crown. At the street level it is 4 ft. thick.



CONCRETE BRIDGE, ANTWERP.

The height of the under side of the arch above the roadway is 14 ft. 9 ins., and the inside width at this level 60 ft. The width of the bridge is 32 ft. 10 ins., and the total length 131 ft. 3 ins.

The ground at the abutments was excavated to a depth of 11 ft., and in doing this a wall about 3 ft. thick was discovered, crossing the line of the bridge obliquely. This wall was demolished to within 3 ft. above the seat of the foundation, and the rest of the ground was found to be tolerably firm sand, slightly argillaceous. The abutments are 16 ft 5 ins. wide, and the concrete was rammed down in successive horizontal layers, each 6 ins. thick.

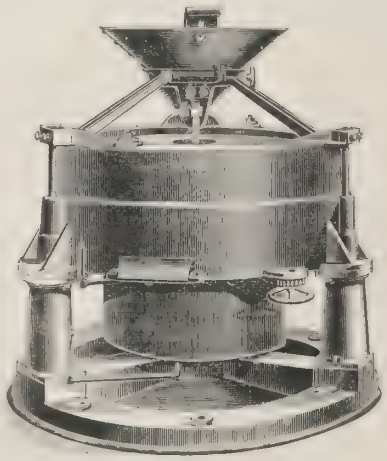
The mixture for the concrete in the abutments was not the same as in that for the arch: but in both cases a mortar was first made, and subsequently mixed with the stone. For the abutments, this mortar consisted of one of cement to four of sand, whilst for the arch one of cement to two of sand was used. In each case 10 per cent. of water was added, to work the materials up into a rather dry mortar. Forty-five parts of this mortar were then mixed with a hundred parts of crushed porphyry. It will thus be seen that in the abutment there is only one part of cement to fifteen of sand and stone, whilst for the arches the proportion is 1 to 8⅔. For the centering five wooden trusses were used, placed 6 ft. 7 ins. apart, and covered with ¾ in. planks. The construction of the arch was commenced on Dec. 18, 1893, and was finished on the 23d of the same month. A week later a severe frost set in, the thermometer falling to 10 degs. Centigrade below zero — 14 degs. Fahr. On January 23 the centering was removed, and though careful observations were made, no settlement could be detected. To avoid the infiltration of rain, the extrados of the arch and the tops of the abutments have been coated with a mortar consisting of equal parts of cement and sand. The balustrade, the lions, and the two condors are made of "Condor" cement, the composition being one to three. An examination of this bridge one year after it was built showed it to be in as perfect condition as the day of its completion; not even hair cracks could be found.

CONCRETE BRIDGE, ANTWERP.

WE have received the following notice from the Sturtevant Mill Company, introducing their new Horizontal Mill.

This Rock Emery Mill illustrates the readiness with which new things are produced when really wanted. The Emery Millstone, as is now well known, is the finest as well as the fastest grinder in the world, but these qualities cannot be fully brought out in an ordinary mill-frame. Any stone, to grind fine and run fast, must be carefully balanced in a mill-frame that will not vibrate. Every vibration throws the stones out of tram and lets out coarse products.

The cut sufficiently shows the great strength and small height of the Sturtevant Horizontal Emery Mill-frame. The 5-in. shaft, to which the running stone is firmly fixed, is so short and rigid that the Emery stone, always carefully made, runs with as little vibration as a clock.



To millers this will scarcely seem possible, but *is a fact*, and these mill-frames are *guaranteed* to do finer grinding than anything heretofore seen. The upper stone is raised and lowered by means of the hand-wheel, but the stones themselves are, by a simple automatic device, kept always in perfect tram, without any attention of the miller.

Bits of iron, or other material, accidentally between the stones do no harm, as they are automatically released and thrown out of the mill. The bearings are bronze and run in oil. The bedstone is bolted in, and cannot be got in wrong. It is difficult to obtain skilled millers, and this mill-frame, with Emery stones, not only grinds everything faster and finer than others, but the Emery Mill is capable of reducing substances that would soon destroy any other grinder.

It is constructed to do a large amount of work, and to give the least possible trouble. Its few parts are interchangeable, and can be replaced at small expense.

We think that any miller will recognize by the cut that this mill is the simplest, strongest, and by far the best he has yet seen.

The face of the Rock Emery Stone, it will be remembered, requires no dressing, and is always sharp.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX.

THE practise of architecture and the construction of buildings in America has, within the past twenty-five years, been practically revolutionized, and the advance made in these departments will compare favorably with that in the other branches of industrial science and art. It is but comparatively few years since the typical office building, for example, was a simple structure of wood and brick or stone, usually not over four stories high, the floors above the street level being accessible only by means of stairways, and each room heated by its own stove or fireplace. The planning and building of such a structure was, of course, a simple matter, for the materials employed were the common, every-day kind to be found close at hand, and practically nothing had to be made which was unusual or out of the ordinary line of work. The trowel and level of the mason, the mallet and chisel of the stone cutter, and the hammer and saw of the carpenter, were almost the only tools necessary to build a structure like this; and the carrying out of such a simple problem required no great amount of technical or artistic training on the part of the architect, or experience, forethought, or executive ability on the part of the builder, particularly as each town or city had a type of edifice which was repeated in its essential features from time to time with comparatively little variation; a familiar example of this being the pressed brick bay-window fronts of Boston, and the flat, brownstone ones of New York. But the introduction of what in itself was a simple device was destined to revolutionize the art of building, for it is the elevator which is mainly responsible for the new and complicated problems which the architect and builder must face to-day. By means of this simple contrivance, rooms on the tenth or fifteenth — and we have been lately told the two-hundredth — floors are made even more accessible and valuable as a source of income than those of the second and third had been before. This fact naturally led the owners of property in the large cities and towns, as soon as opportunity offered, to replace their three or four story buildings with ones of at least six to twelve. And with this added height and the desire, on the part of the owner and architect, that each building should have an individuality of design and use of materials, came the complex problems which confront us to-day. These new conditions affect, to begin with, the planning of the building; for while it may be permissible to have a little waste room on one or two floors, when multiplied by ten or twelve such loss becomes serious. The design of the exterior also requires more careful study, for there is little precedent to help us in a matter like this, and a successful façade for a sky scraper, from an architectural standpoint, is a matter which still awaits an entirely satisfactory solution. The problems in construction which are presented by the high buildings are fully as complicated as those in design. The added height carries with it the necessity of building a structure which is fire-proof, which requires the use of new materials or old materials in altered and novel forms, and the great load on the foundations, the increased thickness of walls, the economical distribution of the iron frame, all combine to require such technical knowledge that the architect has been obliged in many instances to call to his aid the engineer. Added to these problems of a purely constructive nature are those of elevator service, plumbing, heating, and lighting, and it is, therefore, easy to see that the architect who undertakes to combine these varied interests under one roof in the compact form which the economical use of valuable space demands has no easy task before him. And as the requirements and the responsibilities of the architect have increased, those of the builder have grown in the same ratio. The rapidity with which the modern building must be constructed, so as not to lose interest on the investment, the large number of different crafts which must necessarily be employed at the same time and in a limited space, the great depth and height at which much material must be handled and placed in position, these, among many other new requirements, all combine to demand a considerable amount of forethought, ingenuity, and executive ability on the part of the contractor.

The problems involved in the construction of the modern office building are probably the most involved which the architect and builder of to-day are called upon to solve. But the same complications are met, to no small degree, in public and domestic work as well.

It is easy to see that the satisfactory solution of the new and complex conditions which I have concisely outlined must require, first of all, harmonious relations and unity of action between the principles engaged in the carrying out of the work of designing and constructing a building; and in my first paper, to which this is but a brief introduction, I shall consider the relations between the architect and contractor as being a matter of primary importance, and the first which presents itself when the work of building actually begins.

(*To be continued.*)

WHY DO BRICK WHITEN?

EDITOR OF THE BRICKBUILDER,

Dear Sir: — I wish to build a brick house during the coming spring, and as I want to make the mortar with quicklime and hydraulic lime or cement mixed, I would like to know the right amount of each to make the best bond and not go over one half cement. Will you kindly furnish me with the following information. Is cement a valuable addition to quicklime to make a stout wall? Will the addition of cement to white lime mortar tend to whitewash or come out white on the walls, — on brick that positively do not turn white with all quicklime mortar?

My reason for asking this is because there is a chimney built here of about twenty thousand bricks with about one eighth cement mixed with the mortar. Some five or six of these bricks have turned white and there is positively no whitewash in them. These same bricks have been used here in houses built forty years ago, and have never shown a sign of whitewash. 'Tis possible these few whitened bricks that I have mentioned had become soggy wet before being laid in the wall.

Very truly yours,

MONONA, IOWA. GEO. H. JENKINS.

WE have received the foregoing letter from one of our subscribers. It opens a subject we are glad to refer to our readers, and we invite expressions of opinion, knowing that authorities differ as to the value and effect of cement when added to lime in mortar. The saltpeter efflorescence frequently shows on brickwork, especially in the Atlantic States, where the atmosphere contains a large amount of humidity. One view of its cause, and a means of prevention, is shown by Professor Clark's letter, which we add herewith.

EDITORS BRICKBUILDER.

1. Cement is a very valuable addition to lime for making mortar for brickwork; the more cement is added, the stronger the wall will be, the less it will settle, and the better it will keep out dampness. Cement in any proportion will be advantageous, but the larger the proportion of cement, the better will be the mortar, and, consequently, the wall.

2. The addition of cement to lime mortar in any proportion will tend to cause "saltpeter" to come out on the surface of the bricks; and the greater the proportion of cement, the more likely "saltpeter" is to appear. It can, however, be prevented from making its appear-

ance by mixing oil with the mortar before laying the bricks with it. Linseed oil is the best to use, but any cheap "black oil" will prevent the efflorescence. The quantity generally required is two gallons of oil to each barrel of cement.

T. M. CLARK.

BRICK ARCHINGS.

THE arch, as an essential factor in modern construction, has almost disappeared. This is evinced more than anything else by the difficulty in finding workmen who understand how to properly build even so simple a thing as a brick arch in such manner that it will stand without any tendency to open at the joints or push out the haunches. There are two ways to build a brick arch, either one of which will give good results if carried out intelligently and with care. The first method is to lay the bricks dry, without any mortar, setting them in order with proper bond, over the centering, resting against a skew-back which is built with mortar if necessary, but better yet cut to proper slope. If the arch is turned between beams, a little mortar must be used to fit the skew-back beams against the flanges. When all the bricks are in place the arch is carefully wedged up with either slate or brick chips, preferably the former, so that the whole construction is thoroughly keyed, and will probably stand perfectly well of itself without any mortar at all. Next the whole surface is thoroughly grouted with thin cement mortar which is run into all the joints, filling and compacting the whole together so that the arch ring is a unit and sets up like a single mass of concrete. If there is more than one ring to the arch, each layer is set in similar manner.

The second method is the more usual, and in the hands of careless workmen is generally not well executed. The center is laid and the bricks are put thereon, course by course, with the joints filled with mortar, and, after the whole ring is turned, the surface is gone over and wedges of slate or brick are driven in from the top to key the whole together. The mortar of course is stiffer than the grout and usually does not fill all the spaces. Furthermore, there is no surety that the wedges do answer their purpose, and while it is perfectly possible to build a thoroughly good arch in this latter manner, one is not so sure of the results as if it were first built dry and then grouted.

The form of centering used for arches should receive more consideration than is usually given to it. The center for an arch must be as absolutely rigid as the circumstances will permit. If it is at all yielding, the arch is apt to be distorted in the process of building, and any extraneous load coming upon it before the mortar is thoroughly hard may break the set and render the arch almost worthless. This is an extreme case, but it is not unfrequently found that arches are of no structural value because of the haste or the carelessness used in their building. While it is true that the arch no longer plays the part in our construction that it did once, this is no reason why it should ever be neglected.

It is the custom with some masons to build several rings of the arch at once. This does not give the best results. Each ring should be made complete by itself, thoroughly keyed and grouted before the next is begun. Otherwise the arch is very apt to be distorted, and unequal strains produced.

An arch which serves the purpose of a vault must be treated in a very different manner from an arch which is built into a solid wall over an opening. In the case of a vault the centering should be removed before the mortar is thoroughly hard, so that all the bricks will come down to a bearing, the mortar in some places being compressed so that all parts of the arch bear equally. Furthermore, if there are any defects in the arch, they will be found at once and then can be remedied; whereas if the center is kept in position until the mortar is thoroughly hard, it may be found when removed that the center was the real strength of the construction, and that the arch, by reason of careless workmanship and possibly by an unexpected broken brick, is not of sufficient strength. On the other hand, an arch which goes over an opening in a solid wall should have its centering retained as long as possible, and at least until the entire superimposed load has been placed upon it. Theoretically an arch in this position sustains the direct load of all the masonry directly above it. As a matter of fact, we know by experience that such is not the case, and that the amount of masonry which is really held by the arch is that enclosed within the lines of an acute angle triangle whose base is the span of the arch, and whose apex is about twice the span. The masonry above the arch keys itself together, and the reason for leaving the centering in is that the whole construction may have a chance to knit itself together by the setting of the mortar or cement so as to be virtually monolithic. If the centering were removed the arch might settle a little, and there then might come a crack between the crown of the arch and the surrounding masonry.

The strength of an arch is wholly an indeterminate quantity. There are no known rules which can determine it with any degree of reliability. When an arch is considered as being built of individual blocks and the adhesive power of the cement is disregarded, there are methods of calculating the probable resistance to crushing under given loads; but the cement is so important a factor that a brick arch never acts in this way, and a stone arch very seldom. In building an arch or vault the common practise is to make the rise as many inches as there are feet in the span, or to make the radius of curvature equal the clear span; either is ample. Beyond this, if the thickness of the crown is worked out by Trautwine's formula, namely,

$$\text{Depth of key, in feet} = \left(\frac{\sqrt{\text{radius} + \text{half span}}}{4}\right) + 0.2.$$

the arch is pretty sure to be amply strong for anything to be put upon it in an ordinary building, especially as the custom is to fill the haunches roughly with the grout in either concrete or brick. This insures stability, as the point where an arch is most apt to yield is about one third of the way from the spring, where it fails by pushing out. In regard to the thickness of an arch in a wall, custom has established an arbitrary rule that the number of rings in brickwork for first-class work should not be less than three and need never be more than six. Excessive spans, of course, need not be considered, as they are never used in modern construction.

A BILL has been introduced in the New York legislature providing that in the cities of New York, Brooklyn, Buffalo, Rochester, and Syracuse, no person shall practise as a mason or builder unless he is duly registered in the office of the County Clerk; and, in order to obtain such registration, he must be a citizen of New York State; must have served four years at his trade; must have passed an examination before a board of examiners, and must pay a fee of ten dollars. Violation of this statute is, by the bill, to be punishable by a fine of not less than fifty, nor more than two hundred and fifty dollars, or by imprisonment for a term of not less than ninety days, or more than two years, or both, at the discretion of the court.

The board of examiners is to consist of one architect, one mason builder, and three practical bricklayers.

Should this bill become a law, among the many peculiar results would be, the preventing of bricklayers who live in other States to ply their trade in either of the cities named, unless they first become citizens of New York State; this would be particularly distressing to the many bricklayers now living in Jersey City and other near-by New Jersey towns, who obtain work principally in New York City and Brooklyn. Another result would be the shutting out from these cities several large and well-known firms of contractors who are not residents of the State. Although such protection is wrong and absolutely without justification, the latter cited result would, perhaps, be the least felt, as it is unquestionably true that among the leading contractors in the country from the standpoint of ability and experience, many will be found in New York City.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

NEW YORK. — This is the last day of the Architectural League Exhibition. Twice I had looked at it before, and once again this afternoon I walked through it more critically, amid a crowd of interested people, many of whom, fully half I should guess, were women, many girls, these noting technicalities in a way that indicated that they were students, as was the greater part of the young men present.

Upstairs, in the room where the League competition drawings are usually exhibited, was something of unusual interest, something hitherto unseen in this country, a fullset of diplomaed, or diplomatized (we need a verb of the sort and I must hack one out crudely for immediate use), drawings from the far-famed Beaux Arts of Paris.

None is a more devoted admirer than I of French art, French standards, French civilization generally, and the Parisian Institut des Beaux Arts particularly; yet I must confess to a serious disappointment. Prepared to admire, it is a shock to the system to have to withhold admiration.

Going up to curse and feeling compelled to bless is bad enough, but going up to bless and coming down doing quite the contrary has all the distress of an anti-climax.

This illustration with the two adjoining are portions of mantels executed in terra-cotta by the Perth Amboy Terra-Cotta Company for the residence of Geo. M. Hutton, Esq., Newport, R. I.: Peabody & Stearns, Architects.

The problem was the house and grounds of a vast ranch in the Western States of America. Making every allowance for the total lack of information as to American habits, we can pardon the design of an immense stone house, with a two-story hall, 50 or 60 ft. square, at a guess (*salle des pas perdus* with a vengeance), yet only four, although of course very large, bedrooms, for the family, guests being disposed of in several small houses symmetrically disposed near the big one, *pavillons d'invités*, as they are labeled. But a dining-room, perhaps 20 by 40 ft., with no pantry or serving-room adjoining, or as good as none, merely a backstairs, dumb-waiter, and sink, with the kitchen in the basement, quite on the other side of the house, 60 ft. of a walk from the dumb-waiter, seems to the barbarous American mind an arrangement that needs explanation.

So on the exterior has been shown a tower,— actually a tower, — dear to the barbarous American mind but denounced by the Beaux Arts Society, and an ugly tower at that. Yet perhaps, after all, the diploma was awarded to this design for this very reason, that it suited the supposed taste of the aborigines for ugly towers and cold dinners.

There is a fascinating design for a library building for New York in what is called the Hellenic style, a free adaptation of Greek detail to modern masses, in this case worked up with color as a Greek might be supposed to have worked it.

There are one or two other things that hang in my mind, small drawings, among which we must look for the pleasing, most of the big things being ugly.

There is an unusually fine exhibit of decorative work, leathers, mosaics, sculptures, and a room full of the competitive designs for a municipal building for New York City, which so lamentably miscarried.

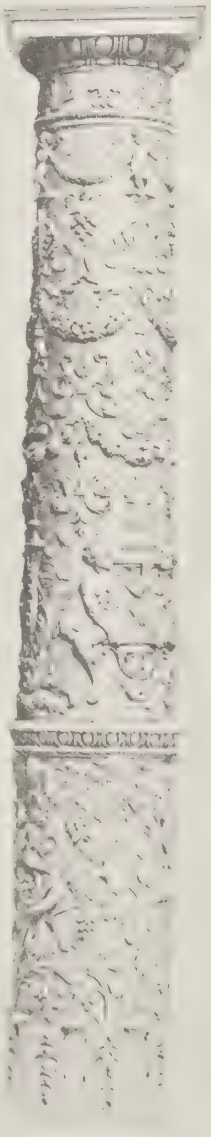
Activity in the real estate market would indicate a lively building year. In addition to the deals and rumors of deals that are ever going on in realties below Madison Square, there is considerable activity manifest in the purchases of up-town lots — principally in the districts above Central Park, on or near Lenox and Seventh Avenues, and Washington Heights. It is safe to predict that there will be more development in these neighborhoods in the next two years than there has been in the past ten.

CHICAGO.— H. H. Richardson was quoted as saying once, after having designed a railway car, that his unrealized ambition was to design a grain elevator. Perhaps that massive product of utilitarian civilization might have been made interesting and artistic under Richardson's hand. The reminder of this thought is the announcement that his business successors, Messrs. Shepley, Rutan & Coolidge, are now engaged in designing fifteen Wagner cars, which will cost $16,000 to $22,000 each. The results, it is to be hoped, will be an encouragement to further architectural improvement of rolling residences.

The Chicago post-office gives promise of keeping up the tradition of government work. Since the temporary post-office (which should have been ready for occupancy in ninety days — October last) was begun, a ten-story office building has been erected and received tenants; and an eighteen-story building has been put up since then and will be ready for tenants within a few days of the time that the post-office employees move into their one and two-story common brick-wood-foundation temporary abiding place.

The October BRICKBUILDER mentioned the probable immediate appointment of an architect for the new permanent post-office. At this writing the appointment is yet to be made. If it had been a private enterprise, plans would have been made and the rolling mills would have been getting out beams and columns by this time, so that the moment the old building is vacated razing would begin.

The business center of Chicago is undergoing interesting readjustments of values and a shifting of retail business districts, with a consequent result in new building projects; and all this is the effect of changing the center of trans-



portation facilities, which now lies chiefly in a north and south line (State Street), to a prospective loop railroad, which will enclose the business district in a hollow square, and from which, as from a hub, will radiate elevated railroads in all directions.

Among the most important new buildings announced are, an office building (addition to the Ashland Block), John Rogers, architect; a park building, by J. L. Silsbee; a wholesale building, by Holabird & Roche; a hospital, by Geo. L. Harvey; and an office building for Indianapolis, Ind., by Henry Ives Cobb.

Chicago feels that she is growing in culture and as an artistic center. One or two buildings are occupied almost exclusively by musicians. Other buildings are distinctively quarters for artists, studios. Entertainments of the class of Tomlin's and Thomas's concerts are not rare and are well supported. Art exhibitions have followed each other in quick succession this winter, the special exhibitions in the Art Institute having attracted much popular interest. One of the latest acquisitions in the Art Institute is a 13 ft. high copy of French's statue of the Republic which graced the "Court of Honor."

A statement in this column last month in reference to "three stories of terra-cotta going to the waste heap" has been misunderstood. No reflection was intended against the terra-cotta manufacturer; his colors and glazes were according to the designer's instructions. The meaning was, that the architect had had the courage, when he found that his color scheme did not have the effect he had conceived when he selected samples, to destroy the terra-cotta so far made and try another combination. An artist may paint out the picture on his canvas and begin again without reflecting on Windsor & Newton, who made his colors.

As a matter of fact, however, in connection with the building referred to, our information, which was considered as coming from the most reliable source, was faulty. The original color scheme was changed on the evidence of samples without destroying good terra-cotta. Successful work in colored terra-cotta, as the result of investigation and persistent experiment, is being done, and there are certainly wonderful possibilities of polychromatic architecture in terra-cotta. But, as has been said, the results in untrained hands are to be dreaded. Bad pictures are more easily escaped than bad buildings.

BUFFALO.— The time seems to have arrived in this city when, after a so long comparatively depressed condition of business in the building trades in general, a reaction is next to inevitable. Judging from the present outlook, architects have more on the boards now than they have had for the last three or four years at this same date. Taking it from a very conservative standpoint, every indication tends towards a very good season's work.

The principal prospective projects are some seven or eight schoolhouses and three fire stations, to be erected by the city; also the long-talked-of 74th Regiment Armory, to be built by the State.

Among the better class of proposed new buildings may be mentioned the newspaper office building for the Buffalo *Evening News*, on Main Street, to cost approximately $100,000. Swan & Falkner, architects.

Theater building to take the place of the old "White House' on Main Street, and to cost $150,000. Green & Wicks, architects.

The John Otto building, 100 by 125 ft., to cost $75,000, by E. A. Kent, architect. Entire front to be of terra-cotta, furnished by the Northwestern Terra-Cotta Company, of Chicago.

Block of flats on Front Avenue, also residence on Oakland Place for Mr. Sprague, both in yellow brick. Winslow & Wetherill, architects.

Five-story bachelor apartment building 50 by 94 ft., to be styled "The Buckingham," situated on southeast corner Allen and Mariner Streets, for Frederick B. Robins, to cost $50,000. E. A. Phillips and A. Pentecost, architects. Red brick and white terra-cotta.

Block of stores and flats, of yellow brick, three stories high; to be known as "The Lincoln," on southwest corner of 14th and Rhode Island Streets, to cost $42,000. Eckel & Ackermann, architects.

Five-story store and tenement building on Main Street, for Mrs. Charlotte Lesswing. Red brick and buff terra-cotta. Cost, $34,000. E. A. Phillips and A. Pentecost, architects.

The Walbridge residence, C. C. Miller, architect, and costing $22,000, is nearing completion, as is also the "Hudson" apartment building for Van Horn Ely, located on Hudson Street, and designed by F. H. Loverin, which cost in the neighborhood of $25,000, and "The Alabama" flat building on Johnson Park, Strong & Wilby, architects. This building is of concrete construction throughout.

The new Methodist Church, corner of Linwood Avenue and Utica Street, S. R. Badgley, of Cleveland, architect, is now just completed.

George J. Metzger, architect, who has the new five-story Philip Becker warehouse building on Pearl Street, also reports a large tenement house on West Ferry Street which will be commenced as soon as he gets his plans completed.

The Real Estate Exchange of ten stories, the "Guaranty" building of thirteen stories, and the magnificent Ellicott Square Office building of ten stories are all now on the verge of completion, and each one being already more than two thirds rented — meaning some six hundred out of a possible nine hundred new offices in these three buildings alone — seems to forecast a future tearing down of a vast number of the old buildings in town, at present occupied as offices, and rebuilding in accord with more modern ideas and conveniences, — all of which will necessarily tend to further stimulate building interests in general this coming season.

Taken all in all, the building prospects are very bright and encouraging, notwithstanding the fact of its being a presidential election year.

The competition for the Newsboys' Home, on Niagara Square, has just been decided in favor of F. H. Archer, of this city. Building to cost about $100,000.

PITTSBURG. — A good bit of church building is contemplated this spring. Architects Vrydagh & Wolfe have prepared plans for a new church edifice for the North Presbyterian congregation, to be built of buff brick, with terra-cotta and stone trimmings, to cost about $50,000. Architect E. B. Milligan has plans for a vitrified brick and stone church to be erected at Station D. The St. Peter's Roman Catholic congregation of Allegheny will erect a parochial school and convent buildings. The school building will be of the steel frame type and fire-proof, three stories high. The buildings will cost $100,000. The St. Wendelin Roman Catholic congregation will build a handsome new church building, to cost about $35,000, constructed of brick and stone; Architect F. C. Sauer is preparing the plans, also plans for a six-story office building of fire-proof and steel construction, to be erected on Smithfield Street. Architects Longfellow, Alden & Harlow have prepared plans for a nine-story brick and stone hotel to be erected on Fifth Avenue, above Smithfield Street, for D. W. Henry, of the Pittsburg Terra-Cotta Lumber Company. Revised plans have been made by Architect J. L. Silsbee, of Chicago, for the new zoological garden to be built at Highland Park; it will be composed of a main building with two wings, to be constructed of brick, terra-cotta, and stone, and to cost about $150,000. There is serious talk of the erection of an eight-story flat at the corner of Palo Alto Street and North Avenue, Allegheny, to cost about $375,000; also of erecting a fine hotel in that city, which will soon be in with this city, and known as the North Side. Architect E. Knox Miller has prepared plans for a mammoth railroad station for the Pittsburg & Lake Erie Railroad to cost $750,000. Architect Charles Bickell has plans for a banking house for the German Savings & Deposit Bank, on Carson Street, South Side, to be of brick, terra-cotta, and stone, and to cost $100,000. Architect Ludwig Dick is preparing plans for a handsome Pompeiian brick residence for G. J. Ramlack, in the East End, to cost about $18,000.

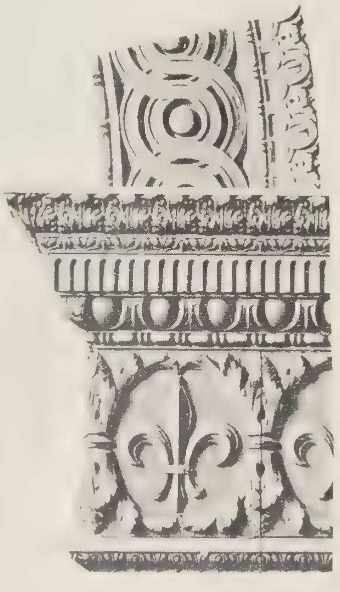
DETROIT. — Notwithstanding the depression in building operations which has prevailed for several months past, architects are generally encouraged by the signs of the times, and confidently anticipate an abundance of good orders as the building season approaches. The competition for plans for the new court house for Wayne County, to cost $800,000, closed March 2. Twenty-seven designs were submitted, — six by Detroit architects and the others from leading eastern and western cities. The six competitors from Detroit are E. E. Myers, John Scott & Co., Nettleton, Kahn & Trowbridge, Julius Hess, R. E. Raseman.

IMPOST CAP.
Executed by Conkling Armstrong Terra-Cotta Company.

An architect will be employed to assist the county commissioners in making a selection, but the appointment has not yet been made.

The fourteen-story building erected by Benj. Hyde & Co., for Mabley & Co., is nearing completion, and is promised for occupancy in April. The two lower stories of the front are of light-gray granite and the remainder of buff terra-cotta, the side and rear walls are of pressed brick of same color. The building is of Buffington's system of steel frame construction, after plans by D. H. Burnham & Co., of Chicago, and will cost $750,000.

The Union Trust Building, by Architects Donaldson & Meier, is also approaching completion. It is ten stories high, of steel frame construction, two lower stories of light granite, the remaining eight stories of buff pressed brick with trimmings of terra-cotta and molded brick. All the partitions and floor arches are of terra-cotta. The completed building will cost about $600,000.


DETAIL ON OFFICE BUILDING, PHILADELPHIA.
Executed by Conkling Armstrong Terra-Cotta Company.

The high school building, by Architects Malcomson & Higginbotham, is to be completed by the coming summer. The exterior is of buff pressed brick with terra-cotta, molded brick, and Ohio sand-stone trimmings, the fire-proofing of terra-cotta. Its cost will approximate $400,000.

Architects Mason & Rice are preparing plans for a $30,000 brick and stone residence for Dr. Franklin H. Walker, to be erected, during the coming summer, on Jefferson Avenue, near Joseph Campau Avenue. Also preparing plans for a fine residence for ex-Senator Thomas W. Palmer, to be built on his Log Cabin Park property, in the northern suburbs of Detroit.

Architect Gustav A. Mueller has prepared plans for a terrace of eight first-class residences for the C. D. Widman estate, to be built at the northwest corner of Warren and Greenwood Avenues. It will be three stories high, with fronts of buff pressed brick and terra-cotta. Also preparing plans for a block for Schwarz Brothers, to contain a store, shop, stable, and residence, with buff pressed brick front. Also completed plans and taking figures for a three-story ladies' tailoring establishment for Jacob Hock, to be built on East Adams Avenue. The front will be of buff pressed brick.

Four new fire-engine houses are to be erected this year, at an estimated cost of $110,000; they will probably have fronts of pressed brick.

Architects John Scott & Co. furnished plans for a four-story office building for Henry K. Jones, now being erected at corner of Clifford and Griswold Streets. The fronts are of buff pressed brick. It will cost $35,000.

Architects Rogers & Macfarlane have prepared plans for a palatial residence for Mrs. John D. Owen, to be built during the ensuing summer on Jefferson Avenue, opposite the Owen Park. It will require a considerable quantity of pressed brick and architectural terra-cotta.

Architect Joseph G. Kastler's plans have been adopted for a three-story parochial school building for St. Anthony's Roman Catholic parish, to cost $25,000. The front will be of pressed brick.

Architects E. A. Walshe & Son have prepared plans for a three-story pressed brick schoolhouse to be erected at Springwells — a western suburb of Detroit. It will cost $19,000.

Architect Harry C. Stevens is preparing plans for a three-story pressed brick double residence for Mrs. C. J. Whitney, to be built on Woodward Avenue north of Sibley Street, at a cost of $17,000.

Architects Nettleton, Kahn & Trowbridge are preparing plans for a four-story apartment house for Edgar S. Dean, to be built on Parsons Street between Woodward and Cass Avenues. The exterior will be of red pressed brick with trimmings of molded brick and Ohio sandstone.

Frank G. Baxter and Frank E. Hill have associated themselves under the firm name of Baxter & Hill, with offices at Nos. 18 and 19 Cleland Building, for the practise of their profession as architects and superintendents.

MINNEAPOLIS.— The brick pavement laid in Bridge Square last fall, as a test, has proven very satisfactory, and but for politics would be the material preferred for the 20,000 sq. yds. to be laid this year. The sentiment of property owners along the streets proposed for new pavement is almost unanimously favorable to brick, which could be laid at a saving of $40,000 to taxpayers and give better satisfaction. But, owing to the aforesaid reason, we are to have asphalt forced upon us, without respect to wishes of property owners. We are to pay 25 per cent. more than St. Paul paid last year for same pavement. Such is politics in Minneapolis.

Among the prominent improvements fully decided upon at present are the following: —

Long & Kees are preparing plans for a five-story business building 100 by 102 ft., at corner of Ninth and Nicollet Avenues, for Gregor Menzel, to cost $75,000.

Warehouse for H. S. Jenkins, Boston, Mass., 115 by 100 ft., four story and basement, on 6th Street, between First and Second Avenues, north, faced with red sand mold brick and brownstone, at cost of $25,000; E. P. Overmire, architect.

Representative Fletcher has a bill before Congress appropriating $1,500,000 for the erection and equipment of an armor plate and gun factory in this city.

WE are in receipt of an unusually pretty brochure, from Merchant & Co., Philadelphia. It is entitled "Overhead," and illustrates a variety of buildings that have been roofed with their Spanish tiles. These illustrations are made very attractive by a color treatment particularly good.

DETAIL ON UNITED STATES GOVERNMENT PRINTING HOUSE, WASHINGTON, D. C.
Executed by Conkling Armstrong Terra-Cotta Company.

I. W. PINKHAM & CO., Boston, Mass., wish announced their removal from 17 Milk Street to new quarters at 188 Devonshire Street, where they will be pleased to receive their friends, or any parties interested in clay products, roofing slate, or building supplies of like nature.

In their new quarters they are arranging a fine display of clay materials which they claim will be second to none in Boston.

They have also increased their facilities for handling and storing goods at their wharf and stock sheds, the same being accessible by rail as well as by water.

ONE of the best evidences of successful administration of business during the hard times through which the country has passed; when so many concerns have been obliged to retrench, is a company which has found it necessary to seek new and more spacious quarters in which to conduct the operation of their business.

This has been true of the Eastern Machinery Company, of New Haven, Conn. This company was recently organized from the machinery department of the McLagon Foundry Company because of the largely increased trade of that department, it having assumed proportions that made the employment of additional capital necessary and a separate organization desirable. The ownership and management have remained identically the same as before.

The new quarters which the Eastern Machinery Company have purchased were formerly occupied by the Frisbie Elevator and Manufacturing Company.

The establishment has been thoroughly overhauled and an addition built which is equal in area to that of the old plant, thus doubling its capacity.

Perhaps one need not seek further for the secrets of the success of this company, than to inquire from those who have used them, as to the merits and lasting qualities of their well-known brick machinery which they have manufactured for so many years.

It is also the intention of the company to make the manufacture and sale of Frisbie clutch pulleys and elevators a strong feature of their business, these same having acquired for themselves a widespread reputation in the market, and being lines quite closely allied to their brick machine business.

WASHINGTON MONUMENT.

As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,
College Avenue, St. Louis, Mo.

We construct and equip brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine — a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, COLLEGE AVE., ST. LOUIS, MO.

HERE IS ONE

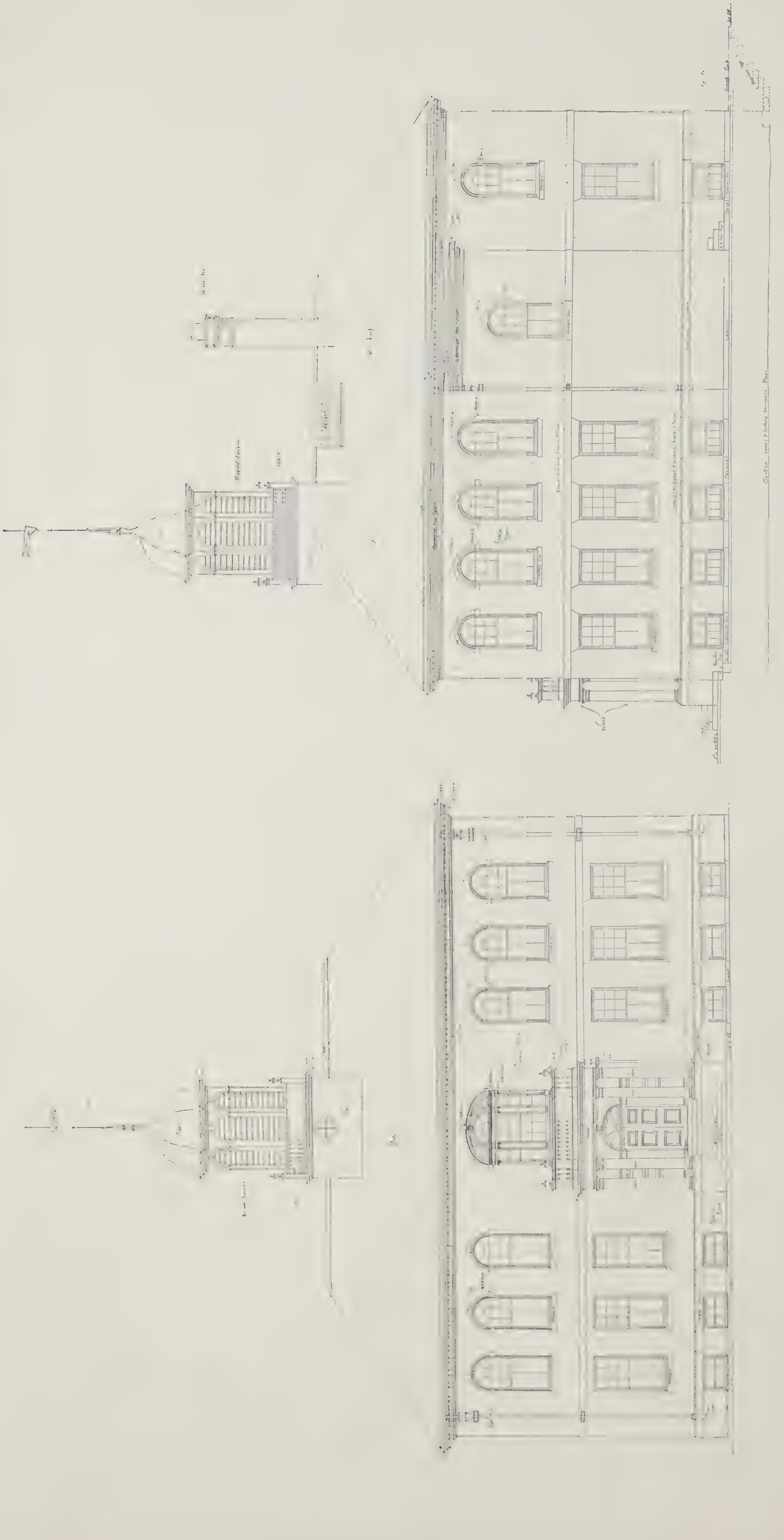
Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

JUST THE THING

FIREPLACE MANTELS MADE OF MOULDED BRICK

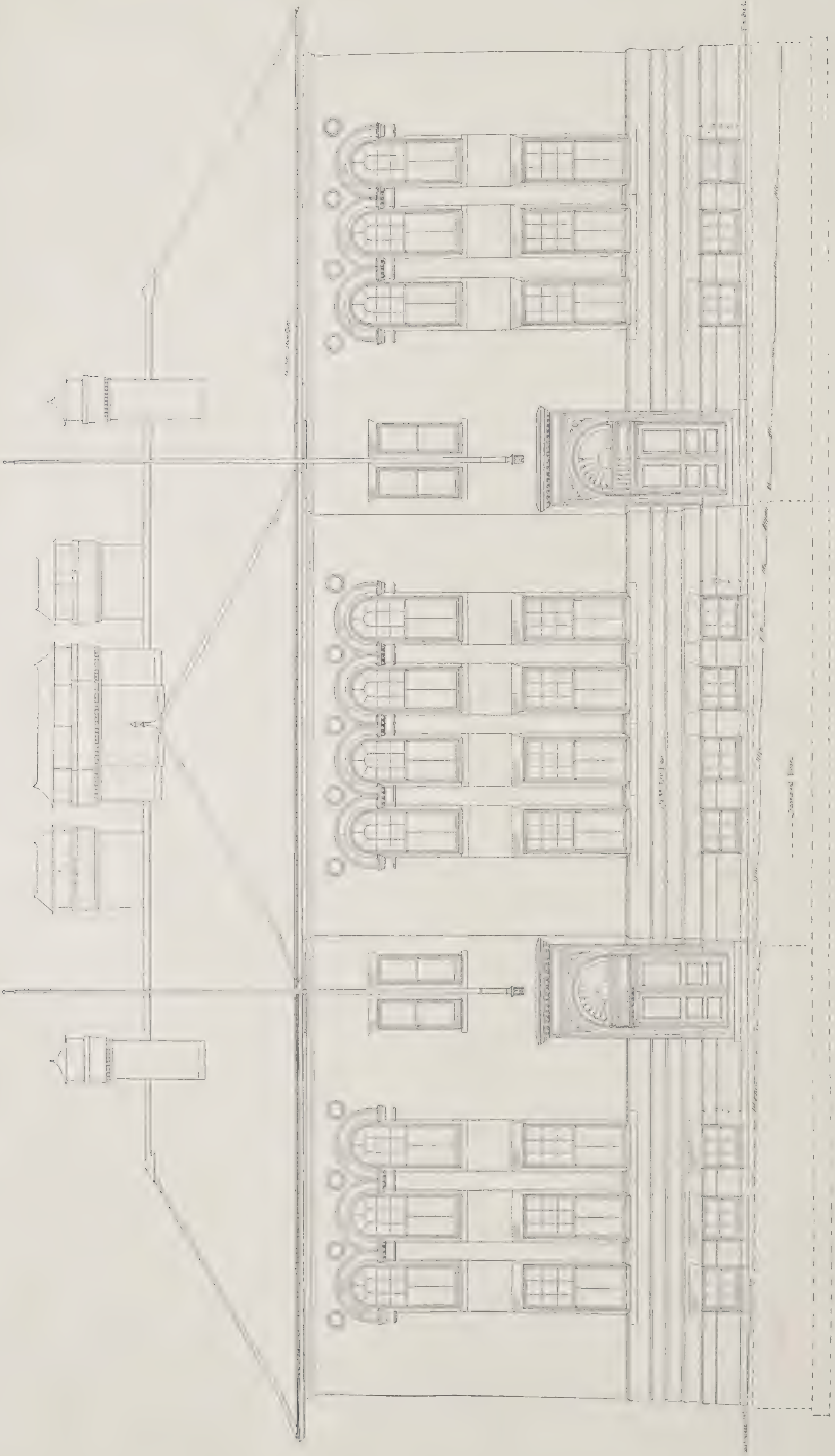
In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

PHILA. & BOSTON FACE BRICK CO.,
No. 4 LIBERTY SQUARE, BOSTON, MASS.



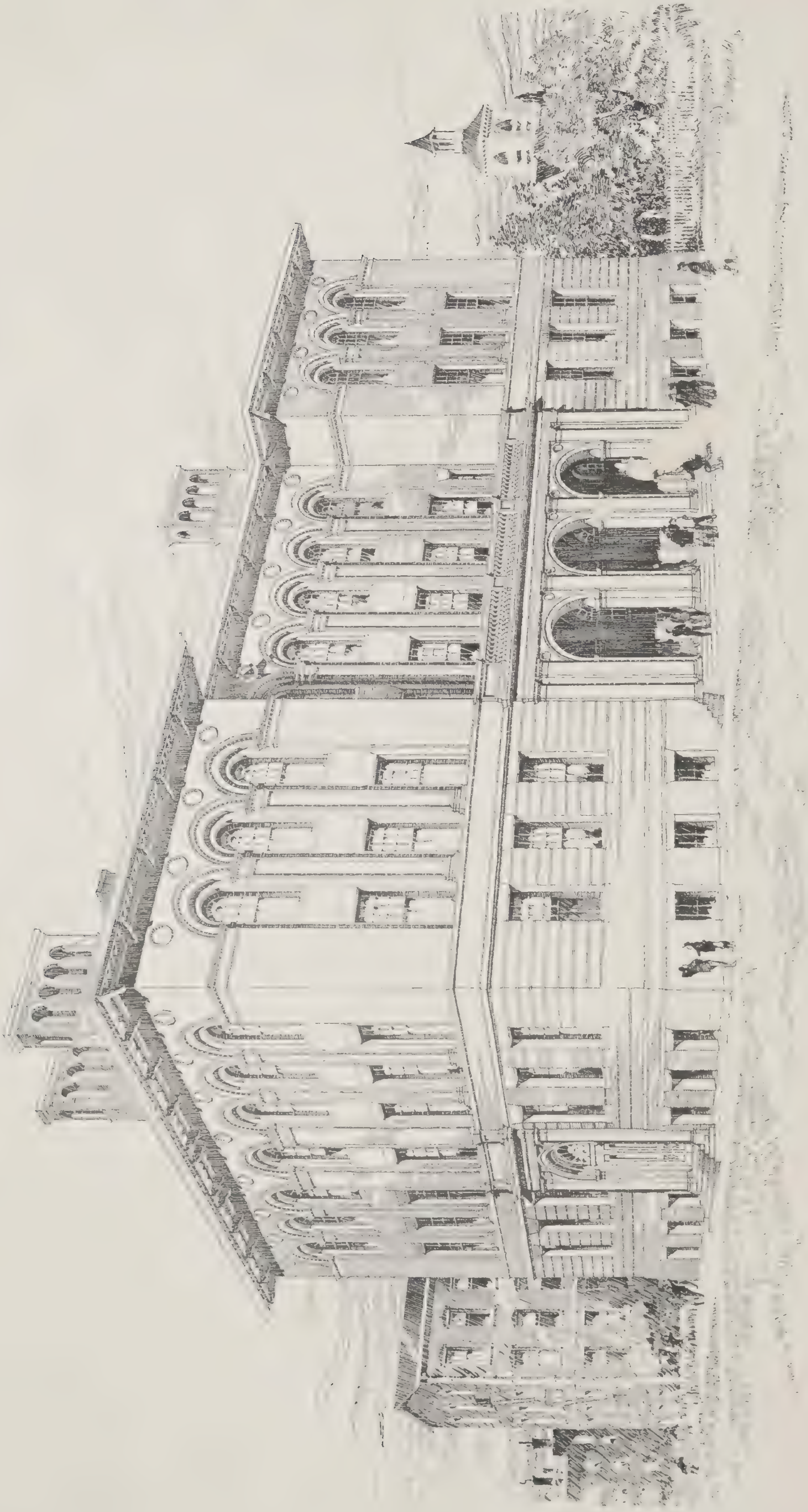
EUSTIS STREET PRIMARY SCHOOL, BOSTON, MASS.

EDMUND M. WHEELWRIGHT, ARCHITECT.



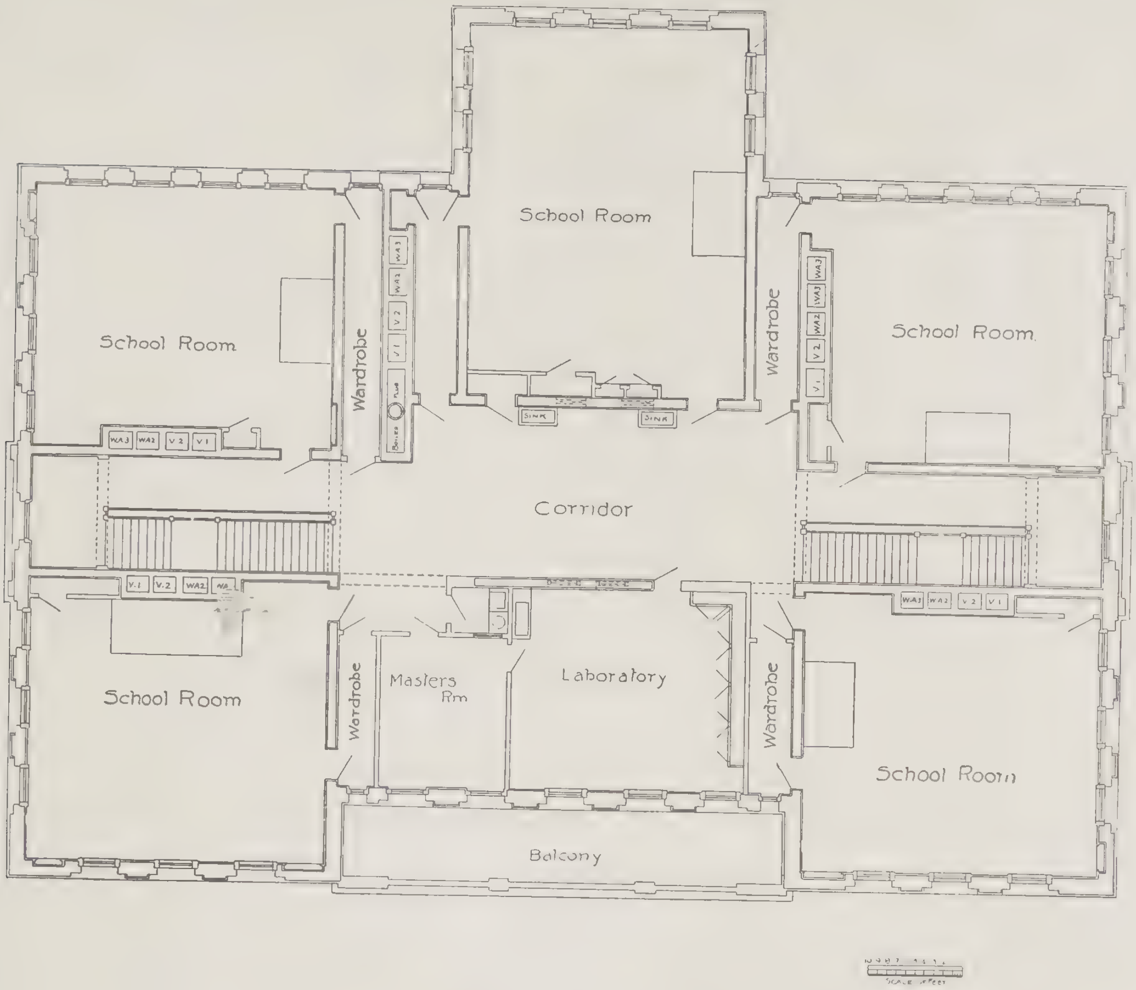
ROBERT GOULD SHAW GRAMMAR SCHOOL, BOSTON, MASS.

EDMUND M. WHEELWRIGHT, ARCHITECT.

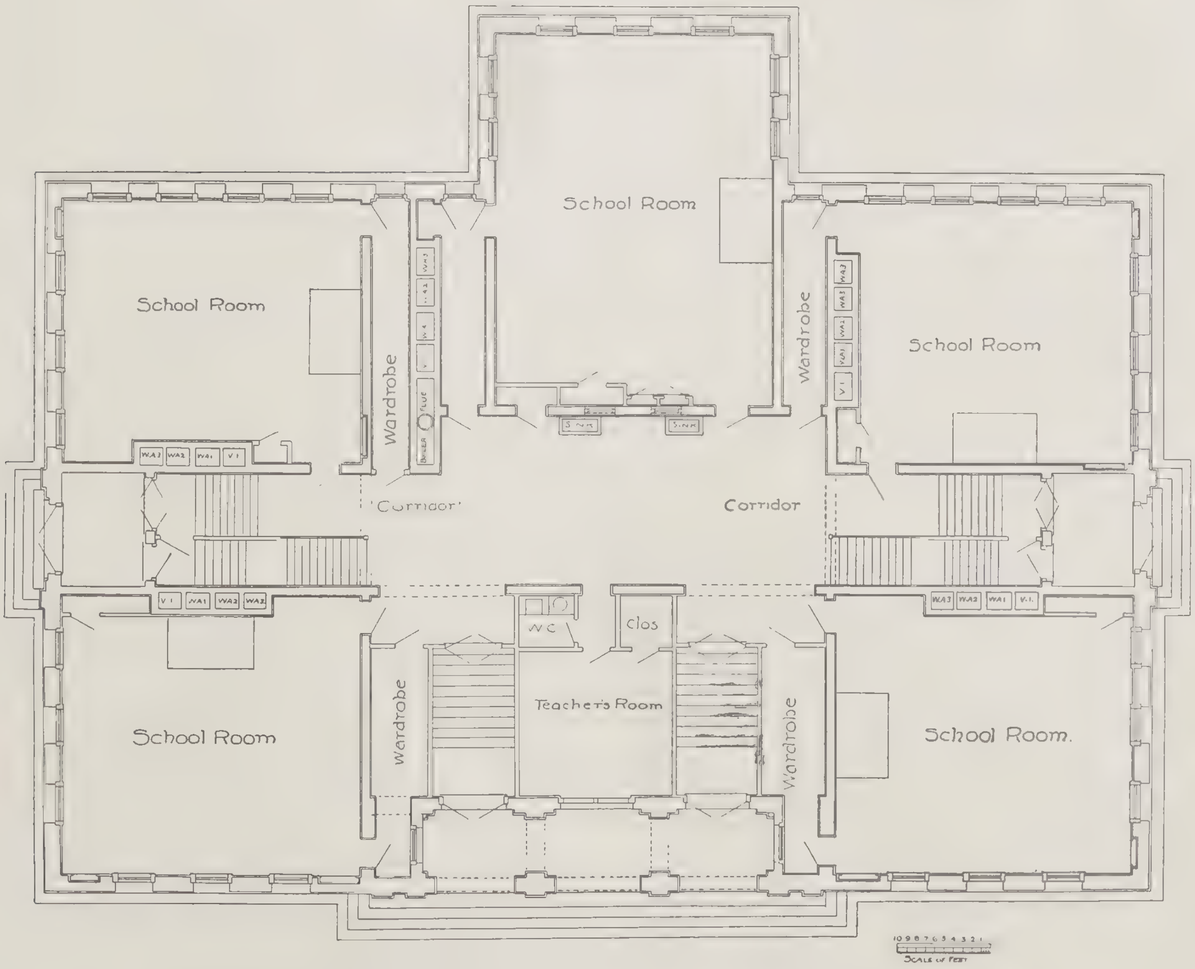


AGASSIZ GRAMMAR SCHOOL, BOSTON, MASS.

EDMUND M. WHEELWRIGHT, Architect.



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.

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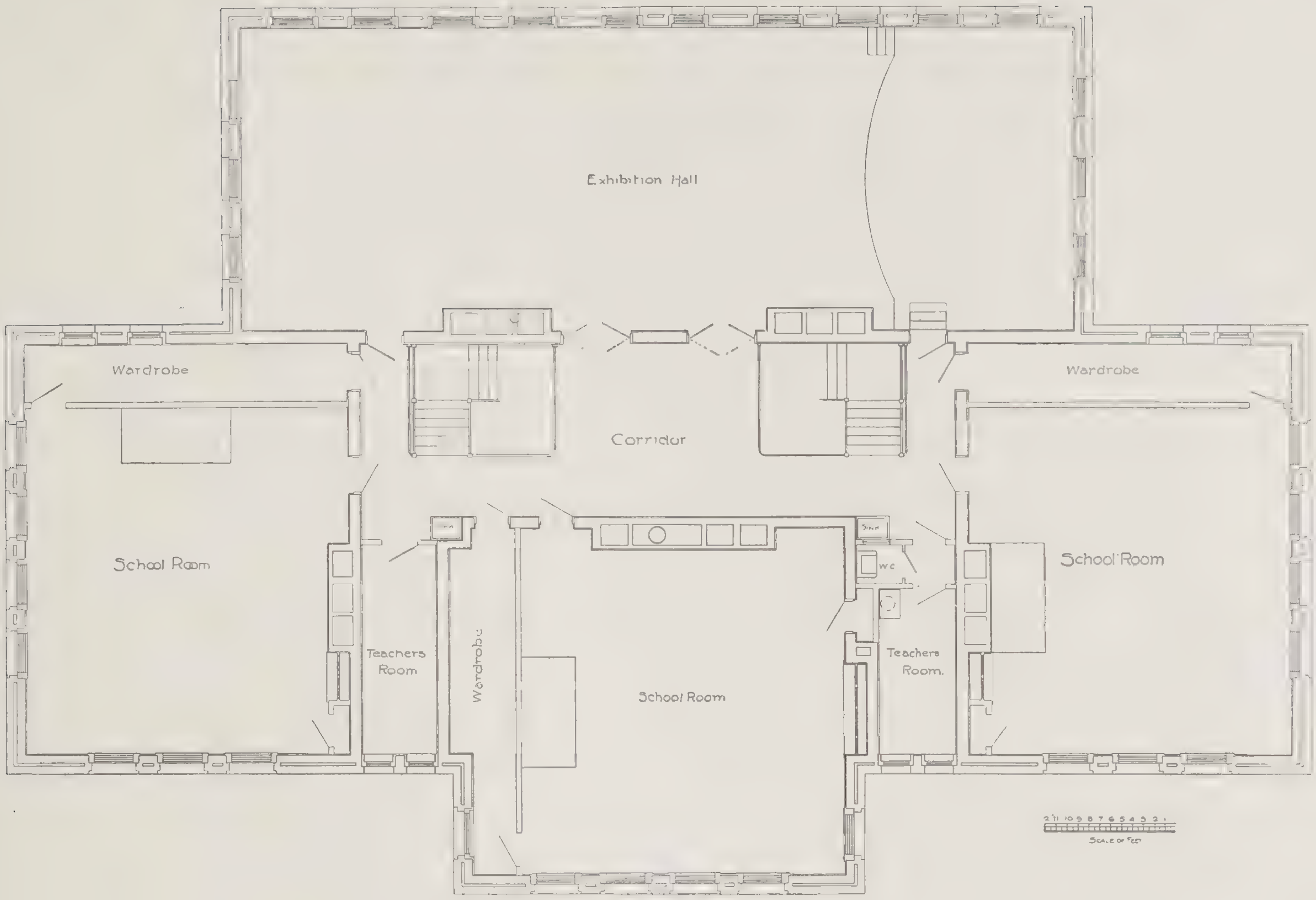

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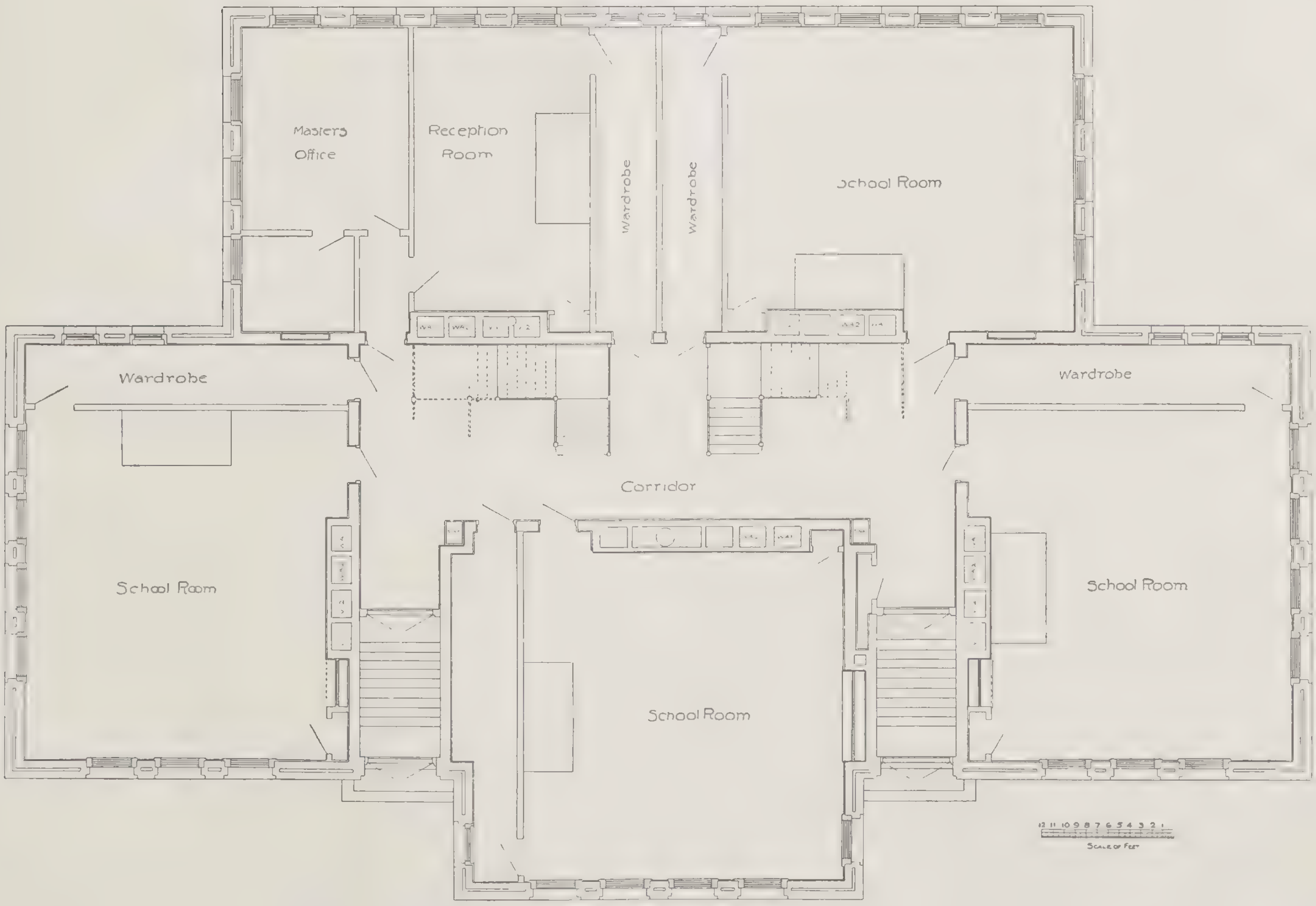


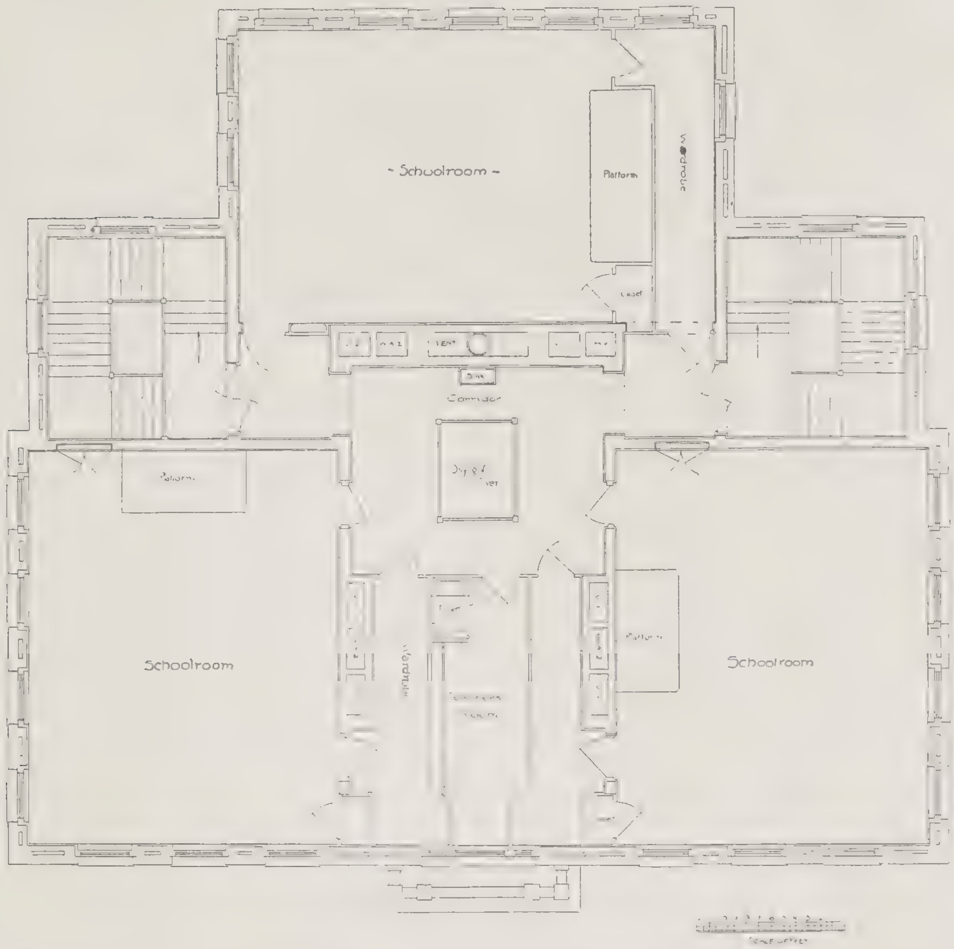
FIRST FLOOR PLAN.

ROBERT GOULD SHAW GRAMMAR SCHOOL, BOSTON, MASS.

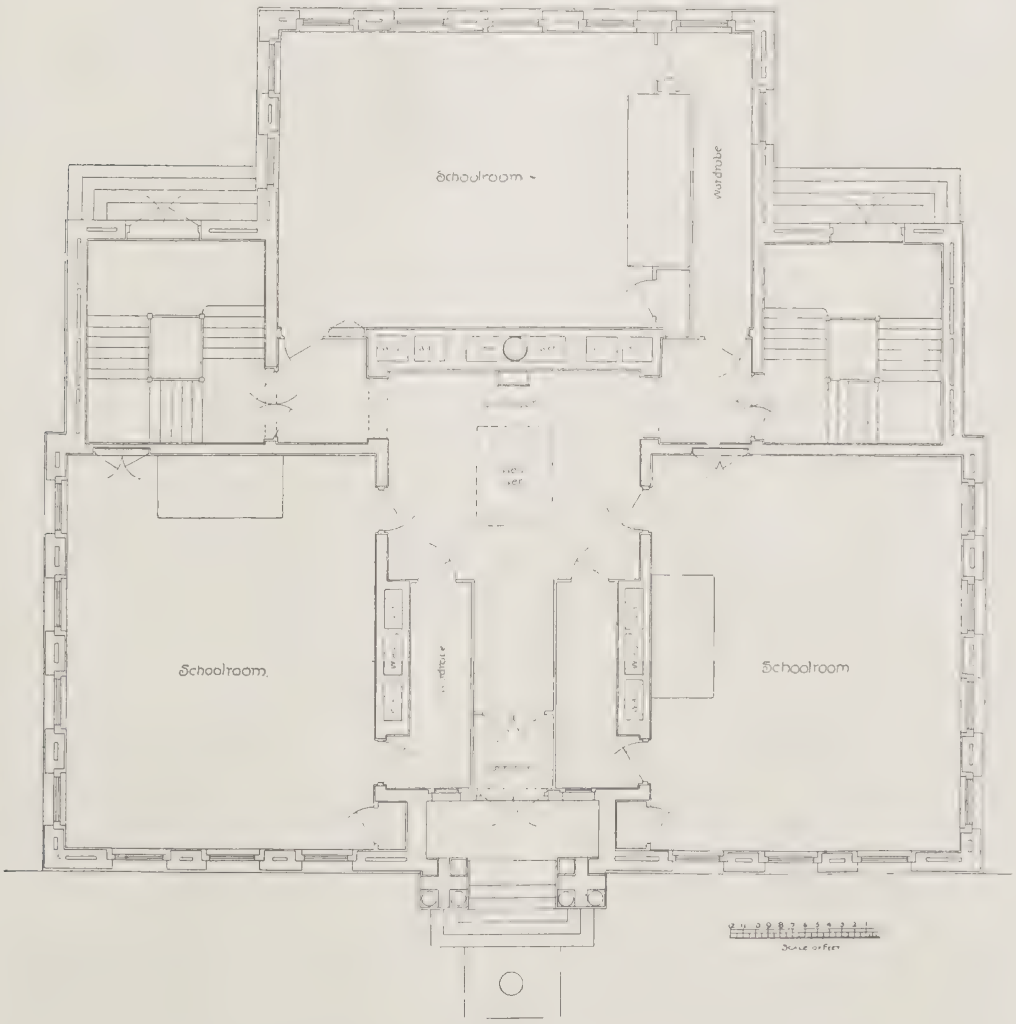
EDMUND M. WHEELWRIGHT, Architect.

THE BRICKBUILDER.

VOL. 5. NO. 3. PLATE 18.



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.

EUSTIS STREET PRIMARY SCHOOL, BOSTON, MASS.

EDMUND M. WHEELWRIGHT, Architect.

VOLVME
V
APRIL
1896
No. 4

THE
BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

PRICE *vs.* QUALITY.

THERE is a tendency of the present market for face brick which ought to be carefully considered by our manufacturers, namely, a willingness to cut prices, which results in emulation of price rather than quality. We do not mean that good bricks are not manufactured; quite the reverse is true, but the price seems to be insisted upon as much as the quality, and the man who can make the best brick for the least money seems to think he has a stronger claim on the public consideration than the one who simply makes the best brick he knows how and charges all he can get for it. We believe this basis is radically wrong; furthermore, we do not believe that it is a necessary one, nor that it really commands any better trade or any larger orders. The price of the face brick is not a very important factor in the cost of a large building, since the total amount which is used is so slight in reference to the general quantity of material that a difference of a few dollars per thousand one way or the other is very seldom considered by either the architects or the owners. We had occasion, recently, to go over the figures of a large commercial building in this city, the exterior walls of which were faced entirely with a high grade of pressed brick for a length of about 200 ft. and a height of 70 ft., requiring altogether somewhat less than 100,000 face brick, the value of which at the prices paid was about $4,000, while the total cost of the building was nearly $300,000. Conversing with the parties who supplied the brick, we were told that a special price was made of $40 a thousand being a cut of about $6 a thousand, which was voluntarily offered by the manufacturer in the hope that that would decide in favor of his particular brick. Talking the matter over later with the architect, however, we found that that cut had been entirely unnecessary; that that particular brick would have been used in any case, and that the difference of $600 was not considered a particle in making the selection; in other words, that $600 might just as well have been in the pockets of the manufacturers.

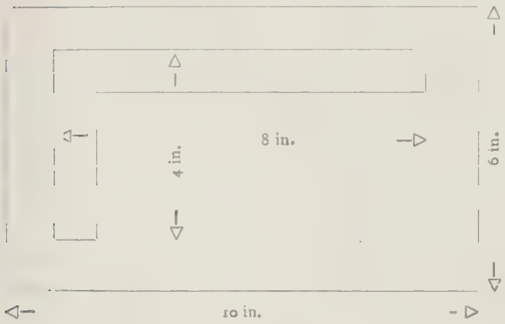
THIS is by no means an isolated case. We believe in most instances architects do not consider the price of face bricks at all, but rather select what seems to them the best for the purpose and order that brick used, a difference of a few dollars per thousand not being a determining factor. If this is a fact, and we see no reason to doubt it, the mistaken policy of undertaking to cheapen a product or to cut prices is fully demonstrated; and if our brick manufacturers would make up their mind hereafter to make the very best bricks they can produce, and sell them for the most money that the architects and the owners would submit to, we believe there would be a great deal less dissatisfaction with the product, and the difference in cost would count no more than it does now, while there would be a very tangible encouragement given to the improvement of the best and most available building material which we have at hand. All bricks are by no means good bricks, and though all manufacturers may know how to achieve the best results, there is a woful difference in the quality of the resulting product. We have extended our range of colors, we have multiplied indefinitely our varieties of forms and to the credit of the manufacturers it can be said that there have been many excellent bricks put on the market, but there seems to be a timidity in charging a good round price for a first-class article; a feeling that the purchaser and the architect will object to the price and that more bricks will be sold by making them cheap than by strictly adhering to what the material is fairly worth. Now, no manufacturer can keep on in business unless he receives a fair price for his product. If we were discussing bricks of all sorts, including common bricks, the point would have less value; but where the entire amount of face brick for a large building cuts relatively so slight a figure, it seems the part of folly for manufacturers to deliberately curtail their own profits with the infallible result in the end of being obliged to lessen the quality of the material or be driven out of business.

WE must admit, however, that there is another side of this question. Architects are too inclined to disregard the intrinsic qualities of the brick and to select simply the make which pleases in color or texture. Consequently, in some cases, an inferior brick is sold at a large profit where a better quality of brick, even at the same price, is not considered. If our architects would insist more rigidly upon the quality, irrespective of price, or considering price only last of all, and would endeavor to secure the very best the market affords, and if also our manufacturers would persistently put forth only their best efforts, would stand on the high ground that they are making a first-class article and are entitled to a high price for it, and that the best is none too good, there would then be an opportunity for a genuine revival in the clay industries which would mean not only better business, better profits, and a more legitimate trade for the manufacturers, but would imply buildings better built, better looking, and more enduring for the architect and the owners.

This is a point which the producers must take to heart. The safe course does not lie along any middle line. The manufacturer, in order to make money, must either turn out a lot of very cheap brick or else a more restricted quantity of very high grade brick, and judging from all our observations, and from what has been told us by manufacturers and architects generally throughout the country, we believe that the best product which the manufacturers can turn out will, in the long run, meet with the better success, will be more satisfactory to every one, and will be more generally used, and this is entirely independent of any consideration of price. We would not mean that manufacturers are to continue making poor bricks and simply put up the price, but if they will take the stand that their goods are the best and will prove it by their products, charging a good reasonable profit therefor, there will be no need of ever cutting their prices or resorting to cheap expedients to obtain the desired results.

The Barta Press Competition.

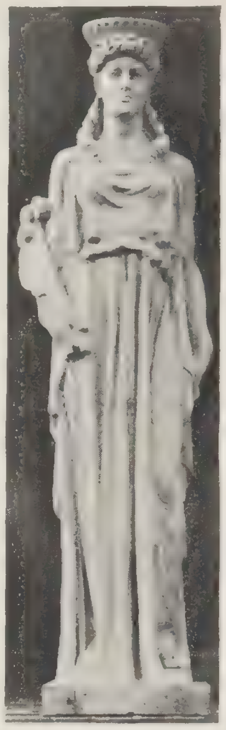
PROGRAM.



WE are authorized by The Barta Press, Boston, to announce a competition for designs for ornamental borders to be used in connection with display printing. These borders should be designed so that they can be adapted to various sizes of pages, and should also be of a nature which will permit of portions being used separately as head or tail pieces at the beginning or ending of paragraphs or pages; consequently, the patterns, while complete in themselves, should be such that will repeat and reverse. The average width of the pattern should not exceed ½ in., and the design should be of a sufficiently bold character to permit of photographic reproduction. The drawings must be made in line with black ink on sheets cut to a uniform size of 6 ins. by 10 ins., and the design should include a corner and 8 ins. of the pattern across the top and 4 ins. of the side, as indicated by the diagram, so as to give a complete idea of the design. For the best designs there is offered a first prize of $50; a second prize of $25; a third prize of $15; a fourth prize of $10; and a fifth prize of $5. The prizes will be awarded by a jury of three architects of acknowledged reputation. Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked and containing the full name of the designer must accompany the drawings. These envelopes will not be opened until after the award is made. After the judges have made their awards, The Barta Press shall have the privilege of selecting for their exclusive use fifteen or more of the designs that are not prize winners, for which will be given the choice of one volume of Bates, Kimball & Guild's "Details of Decorative Sculpture, French Renaissance," or "Details of Decorative Sculpture, Italian Renaissance." Drawings must be delivered flat, express or postage prepaid, at the office of THE BRICKBUILDER, not later than July 1.

The high character of the work which is turned out by The Barta Press has been so abundantly manifested in the pages of this journal as to need little additional comment. The competitors may feel assured that their designs, if used at all, will be most scrupulously followed and all of the prize designs will be published in THE BRICKBUILDER.

ILLUSTRATED ADVERTISEMENTS.



IN the advertisement of the New York Architectural Terra-Cotta Company, on page xxvi, is illustrated the façade of the handsome new office building, built of brick and terra-cotta, for R. Hoe, Esq. Barney & Chapman are the architects. The adjoining illustration is of one of the caryatids, which are placed in the tenth story.

A handsome residence on Michigan Boulevard, Chicago, of which W. J. Brooks is the architect, is illustrated in the advertisement of the Celadon Terra-Cotta Company, Charles T. Harris, Lessee, on page xxiv.

The extension to the United States Hotel, Boston, Winslow & Wetherell, architects, is the subject chosen for this month's illustration in the advertisement of the Boston Fireproofing Company, page xii.

NEWCOMB MEMORIAL BUILDING, NEW ORLEANS, LA.

PLATES 19, 20, AND 24.— The H. Sophie Newcomb Memorial College Art Building, a two-story brick and terra-cotta structure of Italian Renaissance design, by Wilson Eyre, Jr., Architect, Philadelphia, Penn., is situated on the grounds of the college at New Orleans, La. This building was built among other old college buildings, and at the same time there were a number of old live-oak trees not to be disturbed; hence the shape of plan.

The basement, which is only slightly below the grade level, on account of the wet soil, contains lunch, dressing, and storage rooms.

The first floor, as the plan shows, is divided into rooms for oil painting, water-color painting, modeling, drawing, and draughting, each averaging in size 19 by 30 ft., and all opening into a main hall, with library at the northeast end of same.

On the second floor are two galleries 20 by 34 ft. each, used for exhibition purposes; two studios, life room, cast room, also suite of janitors' living rooms.

All the art working rooms on first and second floors have north light, and studios and art galleries are lighted by skylights.

CHICAGO ARCHITECTURAL CLUB.

CLASSES.

THE classes of the year will be kept up and meet as follows: —

Every Tuesday evening will be devoted to the study of the regular problems in architecture.

The class in Pen and Ink Rendering meets every Thursday evening.

The class in Architectural Modeling meets every Friday evening.

The class in Sculpture and Drawing from Life meets on Saturday evening. This class is conducted jointly by this club and the Chicago Society of Artists.

The class in Water Color meets on Sunday mornings.

No tuition is charged for any of these classes.

The ninth annual exhibition of the club opened April 7.

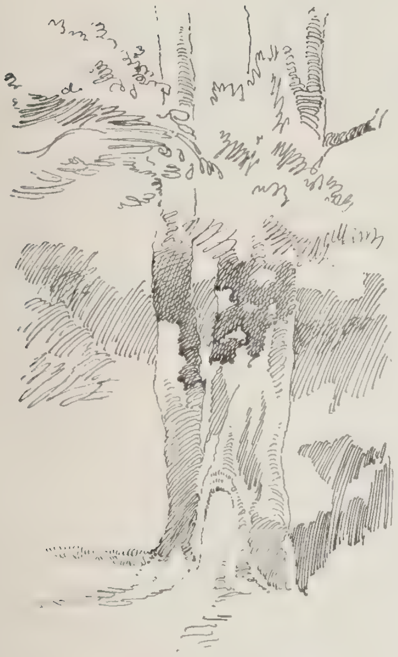
The officers of the club are George R. Dean, president; Richard E. Schmidt, 1st vice-president; Myron H. Hunt, 2d vice-president; Frank M. Garden, secretary; Edward T. Wilder, treasurer.

PERSONAL.

CLARENCE P. HOYT, architect, has opened an office at 194 Boylston Street, Boston, Mass.

Architectural Rendering in Pen and Ink.

BY D. A. GREGG.



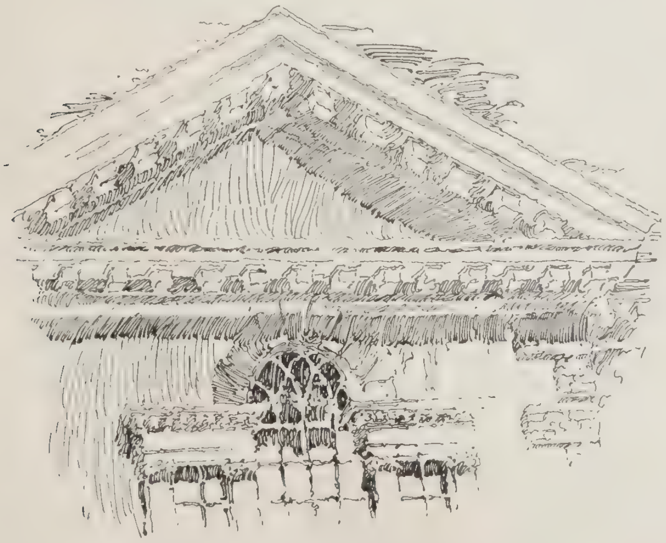
FROM A DRAWING BY MR. W. T. PARTRIDGE.

AWAY back in the seventies, while a draughtsman in an architect's office in New York, that liking for pen and ink rendering came over me which seems to strike nearly all young draughtsmen, and in course of time, by a kind Providence, an opportunity for constant practise was put in my way through an engagement with the *American Architect.* This was in 1879. One would be exceedingly dull not to learn many things about the work in sixteen years of practise, and a lesser number of years of effort to teach others how to render. But it did not take sixteen years to impress upon me one thing, viz.: that rendering in pen and ink was not the easiest thing in the world to learn. My failures taught me that very soon, and the failures and disappointments did not seem to let up at once. I would not care to go over the same ground again; it gives me a heart-ache to think of it. In my teaching experience I observe occasionally one who easily overcomes the various difficulties, and quickly comes to a fair amount of skill; but when one out of fifty does this, thirty have to work hard to get there, and the remaining nineteen never arrive.

The reasons are easily found, there is much to learn, and much time is necessary to learn these things. Some have abundant talent, but the time to practise they cannot easily get, as any draughtsman in an office understands. And some ought not to hope to acquire skill; their talent lies in another direction. A fair amount of natural talent is absolutely necessary.

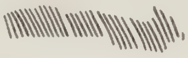
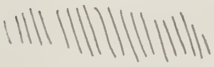
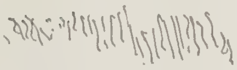
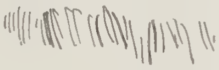
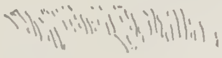
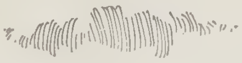
A good pen drawing of a building should be as good as any other drawing by any other kind of an artist.

There should be no method peculiar to ourselves as architectural draughtsmen. Only we should indicate architectural detail better than other artists do.

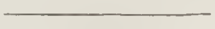
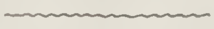
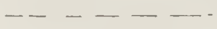
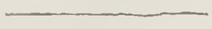
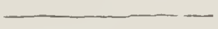


FROM A DRAWING BY MR. FRANK A. HAYS.

VERTICAL LINES IN COMBINATION.

	Rude, clumsy, unfeeling.
	Loose, liny, too widely spaced.
	Weak, lacks spirit.
	Thick and thin, disagreeable.
	Broken, exceedingly bad.
	Good, put together with some grace, variety in direction. United in a pleasant way.

INDIVIDUAL HORIZONTAL LINES.

	Free hand, but so straight as to be wiry and unfeeling.
	Too monotonous in its wave.
	Broken: bad: usually needless.
	Thick and thin in spots. Weak.
	Of even thickness, undulating, has feeling. A good line.

An A1 architectural rendering should have the following qualities: —

1. Good drawing (perfect form in everything shown).
2. Excellent quality of line.
3. Agreeable combinations of line (technique).
4. Shade and shadow nature-like.
5. Value of black, white, and half-tone in right amount of each.
6. Values agreeably arranged (composition).

Each one of the above six items are a study in themselves, and in every drawing all must be considered every time. No wonder progress is slow and failure frequent.

Good drawing there must be. I do not know of any one who has become celebrated as an artist in any line of work who draws badly. And there are some whose strong point is their good drawing, who are loudly praised for their rendering.

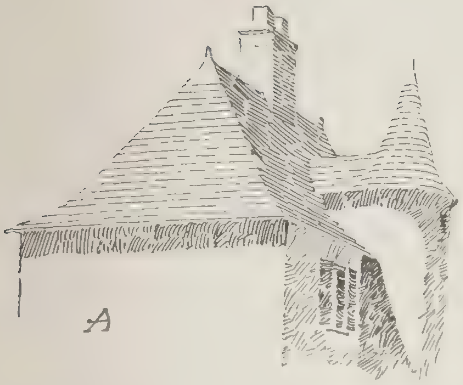
If you will look closely at the work of Daniel Vierge, you will see that his success is not so much in the rendering as in his perfect, magnificent drawing of form and detail.

Architectural draughtsmen sometimes fail to draw architecture well; but supposing this to be overcome, as it ought surely to be, what about accessories, foliage, and figures? Leaving figures out, which are often not missed, we cannot always omit foliage. We have spent years of study on architecture, and draw that properly; but, alas! on foliage we have not spent twenty-four hours, and trees need about as much study as architecture.

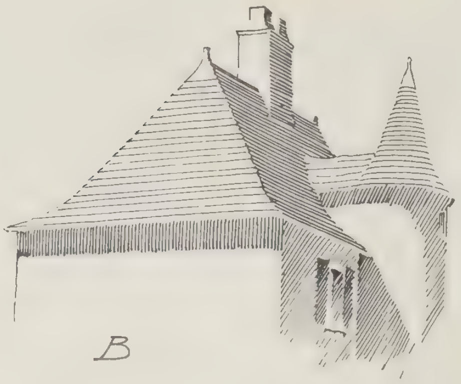
The outer form must be foliage-like, and tree shapes are so varied. The subject seems too large to be attempted in a brief article. But one hint let me give: select tree forms that are most agreeable, the maple, for instance, whose shape is full and rounding. Avoid sharp angles and rectangular shapes, which are unnatural. Make good use of the light holes that occur near the outer edges.

With all the difficulties belonging to foliage drawing, we nevertheless have in the architectural field some who draw foliage well.

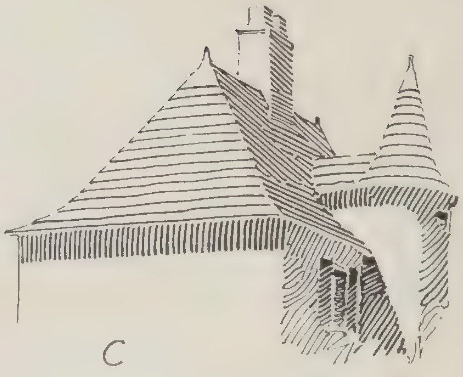
Architecture is not bereft of artists in drawing, whoever may say to the contrary. Observe this bit of shrubbery and grass, drawn by



BROKEN LINE. DISAGREEABLE SPOTTY EFFECT; A VERY COMMON FAULT WITH BEGINNERS. A SHORT BROKEN LINE IS A DANGEROUS ONE TO USE.



SEVERELY STRAIGHT, AND ON THE SIDE. ALL IN ONE DIRECTION. GENERAL EFFECT, HARD, DRY, MECHANICAL.



NOT A BAD DIRECTION OF LINE, BUT COARSE AND RUDE. THE LINE IS TOO PLAINLY SEEN.

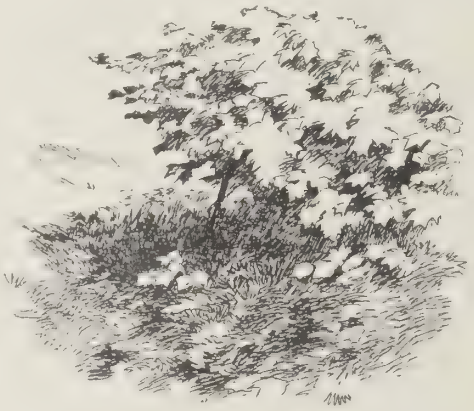
Mr. P. G. Gulbranson. No mannerism or slightest suggestion of T square practise, but a skillful, dexterous, truthful rendering, to which any artist might be glad to lay claim.

In the *American Architect* of Feb. 17, 1894, Ventfort Hall is a beautiful example of Mr. Gulbranson's work, in which foliage and architecture are treated in a masterly way, faultless, it seems to me.

In foliage rendering, Mr. Bertram G. Goodhue also displays great skill, always good in form, happily introduced, and most skillfully executed.

Nothing but long, persistent practise will bring right results in foliage drawing, and it is greatly to the credit of any architectural draughtsman, with time-consuming office work on hand, to gain sufficient skill to draw foliage well.

But I turn with interest to another phase of the work, which, by the way, strange to say, draughtsmen often fail to appreciate, — *quality of line.* The accompanying illustrations will explain. It was three or more years after my work was well begun before I realized the value of making the individual line a good one. But it is very easy to comprehend that as a drawing is made up of a great number of single strokes of the pen, it will make a great difference in the appearance of the drawing as a whole if the strokes are graceful or rude. All else being right, graceful lines will make a beautiful drawing. Yet I know some men of great skill, like E. A. Abbey, seem to make no special attempt in this direction, effect being the object gained by any sort of line; but, nevertheless, his line is never bad, only used as a means to an end. But there is no reason why additional interest may not be given to the work by making each line a line of beauty.

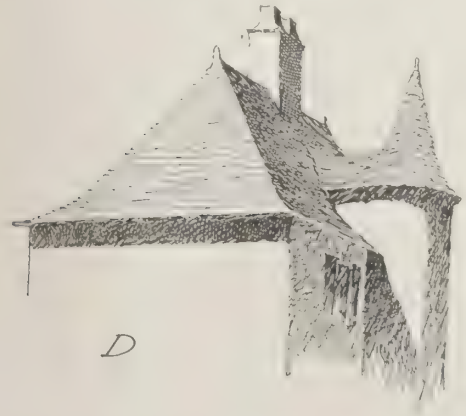


A BIT OF FOLIAGE BY MR. P. G. GULBRANSON.

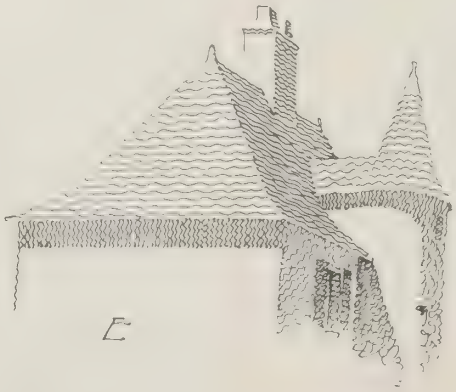
In the architectural field there is one who, in my estimation, has skill in this direction to a remarkable degree, — Mr. W. T. Partridge. I have taken the liberty to extract from one of his published drawings this bit of accessory which came in at the side of the house, illustrating well his most beautiful swing and grace of line.

I do not see how the individual line could be made more perfect or combined with others in a more charming way. In his architecture, too, the same skill is shown. The *American Architect* of Oct. 28, 1893, contains a drawing by him, — Pavilion at Forest Park. There are two drawings with the same title. His drawing has a lady in the foreground. Mr. Partridge's modesty not permitting him to put his name to the work, I mention this. I look upon this drawing with great admiration. Its values and their arrangement are excellent, and through all his superior line gives a quality to the work which is delightful.

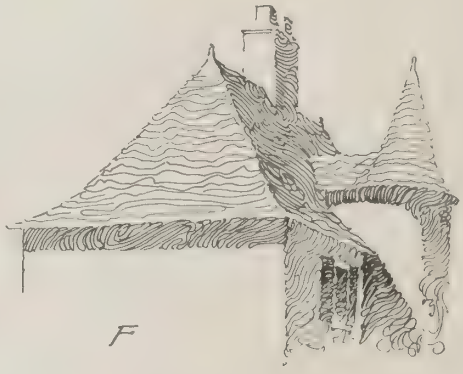
Another one of our architectural family, Mr. Frank A. Hays, has always greatly attracted me by his use of the line. It is a line perhaps a trifle less finished than Mr. Partridge's, but exceedingly good, full of feeling.



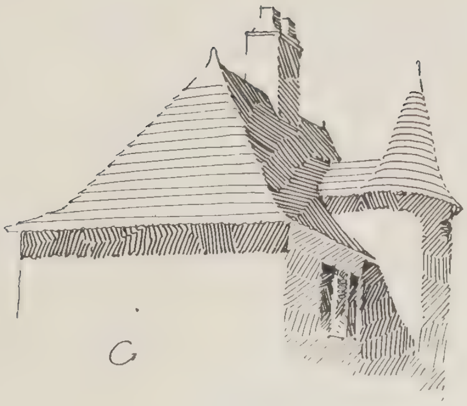
OVERDONE, LABORED, SCRATCHY. A METHOD REQUIRING SKILL, BUT CAPABLE OF EXCELLENT RESULTS.



LINE SO REGULARLY WAVED THAT IT APPEARS MACHINE-LIKE. MONOTONOUS. THERE SHOULD BE NO SUGGESTIONS OF ANY PECULIAR LINE.



FREE LINE, RATHER TOO FREE; FANTASTIC. THIS METHOD SPEAKS TOO LOUDLY. KEPT WITHIN BOUNDS GIVES EXCELLENT EFFECT.



IN THE SHADE AND SHADOW, REGULARLY ZIGZAG, HARSH.

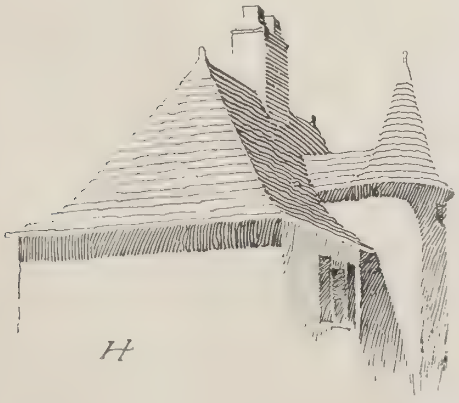
In speaking of the individual line, it is difficult not to consider at the same time the line in company with its fellows, its combination, the technique. Nevertheless, the two qualities are distinct, and may be considered apart. I believe the beginner should *draw* his line, not too slowly, but seek to make it perfect, and to do so there should not be haste; thought should go into every stroke. After long experience naturally the work will be done more rapidly, so rapidly, perhaps, that an observer might not discover any evidence of care, nor would the draughtsman himself be conscious of particular thought about the individual line, but thought there would be with quick execution gained by long practise.

A pen drawing or any other should appear to be easily done. Evidence of this must appear, not so much in the line as in its general technique. This subject of method, manner, style of rendering, or technique, is a large and interesting one.

The variety in style shown by various skilled draughtsmen is most interesting. After some experience in rendering, the individual traits of the draughtsmen are sure to be manifested. It would be interesting to inquire into the causes that lead to the formation of an individual style. Copying drawings early in one's experience has much to do with it. Some good may come of it, but it has the serious evil of hindering the formation of an individual method, which is so refreshing to observe. The best practise is to draw direct from nature as much as possible, to get natural effects of shade and shadow, and in the execution of these effects choose your own method. After attempts of this kind the student is in a condition of inquiry and interest as to how others do their work, and hints obtained then by observation are quite sufficient.

I know of only one general rule that should guide in this matter of method or technique. Assuming that our object is to present an agreeable picture of the subject with the best and most desirable effect of light and shade, *any peculiarity in technique that calls attention to itself unduly may be considered a fault.*

The few examples of rendering here submitted of the little housetop will illustrate my thought. Every one of these examples contain the germ of something good, and, if intelligently handled and modified, would be as acceptable as the one marked H. This one is by no means the only quiet reasonable rendering possible for it. Twenty experienced men would produce each their own, unlike his neighbors, and all might be equally excellent in result.



AN EFFORT TO AVOID A CONSPICUOUS METHOD, QUIET, UNOBTRUSIVE.

Notes on Design of Brick Buildings.

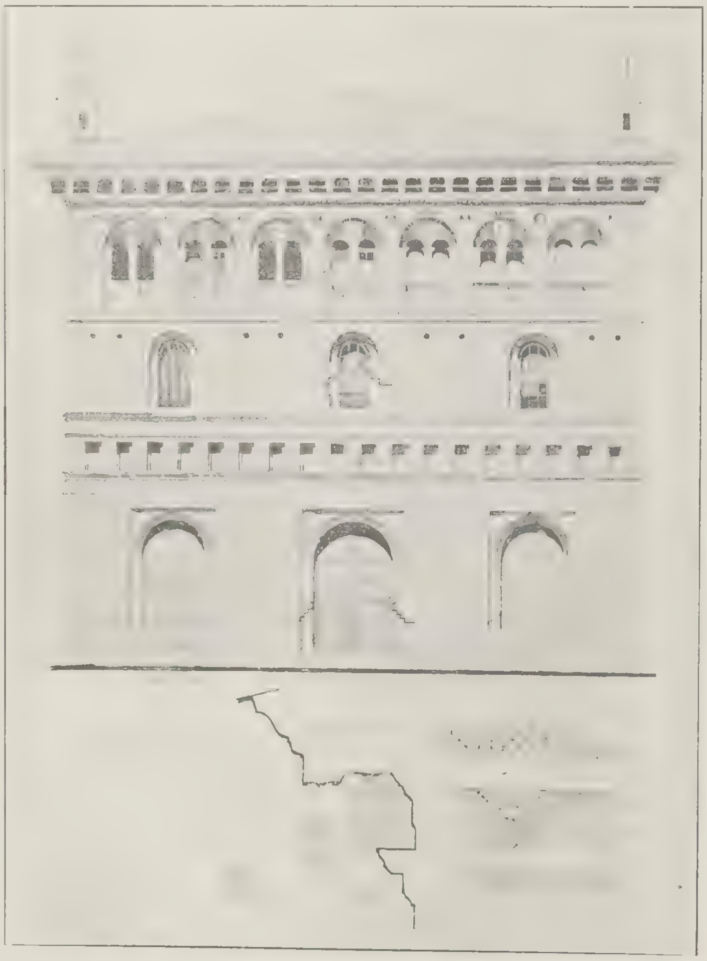
BY GEORGE F. NEWTON.

BUILDING and architecture are so interwoven that it is not always easy to draw the line sharply between them. There are few buildings which have not some pretense of being architectural. A simple brick building entirely devoid of ornamentation may, through some inherent quality, arrive at this effect. The result may be purely accidental, or, perhaps, carefully considered by an artist. We can readily call to mind such structures abroad and at home, which, from their size and fair proportions or color, with apparently no effort and no attempt at ornamentation, may be thus classed. As with all architecture, the composition of mass is the most important element. It is seen from far and near. In many cases the proportions of a building are largely governed by the requirements of the problem, and the architect is often sorely tried in preventing the practical difficulties from destroying his architecture. There is generally some creditable way out of the difficulty, and an architect has generally the excuse of inexperience or carelessness who permits a problem to get the better of him. Mistakes are too often made in attempting too much in the conception of a design. There is always a particular element or character in every building scheme, which, if the designer appreciates, can be played upon, and if treated in a masterly manner, however simply, will give the building a truly architectural character. If it is of great size, pleasing lines and masses may be sufficient; the money may be expended in giving these great surfaces an agreeable form rather than on ornamentation; a more pleasing sky line, or a heavier basement and cornice, or deeper reveals to the openings; such a mass may not actually require ornamentation, although its beauty would doubtless be much enhanced by its use. An ample mass, controlled by a sensitive hand, will make a building architectural in the grandest sense.

A large building, such as a warehouse, a manufactory, a tower, or a bold, simple dwelling in a rugged country, can be given added character by the use of heavy Roman brickwork. A very small building can be given a noble air by the use of a large scale material. The huts of the peasants in the Welch Mountains are made architectural by the use of large blocks of stone. It is a mistake often made to believe that the material of which a building is built should be necessarily in scale with it; namely, a large building constructed of large blocks, and a small one of small pieces. The reverse is more often true, for a small material cannot make a small object look large if it is really small, and the small scale of the wall units of a great object does seem to assist by comparison to increase its size. There is much beauty in a wall of our common red bricks with the usual ⅜ in. white mortar joint. When the bricks are well burned and deep in tone, and the wall is nicely proportioned with simple and studied breaks to give some play of light and shade, it may certainly be architectural. The individual bricks are lost in its vastness, and one complete agreeable whole is the result.

A well-known element of success in the practise of architecture is the appreciation of opportunities when they are presented. They occur to the architect frequently, and if one could get away from the feeling, "If I were only doing another kind of building, or if I could do this in some other material than the one imposed on me, I could make something of it," the result would often be better. The painter at work with the brush often feels that if he only had a piece of charcoal in his hand he could draw a thing just as he wants it, and *vice versa.* This is a common weakness of human nature to which the designer is a particular prey. There is a treatment of the problem in hand, in the material demanded, which will give the building some individual character and make of it a work of art; this, surely, is the architect's joy in his art, to take an intractable material and a difficult condition in plan and composition, and conquer both with intelligence and artistic perception. It perhaps requires more knowledge to do a good, simple architectural building. As a rule, the simple, unpretentious one gives the least offense, and when the artist has produced a good, simple, architectural building he has proved himself decidedly more a master than one who is obliged to have recourse to ornamentation to call attention from poor composition. It is unfortunate, but true, that the majority of people consider a building as a work of art in proportion to its load of ornamentation; and it is evident from some of our atrocious modern façades, without a square foot of surface on which the eyes may rest, that some architects also believe an exhibition of this sort is architecture. The fault is not that a building is enriched; there are many buildings where a rich treatment is desirable and appropriate, but the principle of contrast in decoration is too little heeded in the revel of the modeler in a plastic material, beautiful of itself, ignored and shamed by fretting its entire surface with ornament which tells no story except extravagance and its adaptability to endless reproduction. This is one of the misfortunes of his indispensable material. It is indeed possible, and even usual, for men to sink into machines themselves, so that even hand work has all the character of mechanism.

The Italians, who were masters of the art of decoration, both external and internal, whether of encrusted marble or brickwork, have left us a wealth of examples which we would do well to study. As the lesson we learn from ancient Roman brickwork is one of construction rather than of design, the brickwork forming the ground for the encrustation of marble and stucco, it will not be considered in this article excepting as the organic form of the buildings is suggestive. There is much to be learned from Roman buildings in the way of composition and suggestive forms. Had the Romans not used marble or an encrustation of any kind, many of their edifices would be instructive from a point of view of composition which is as applicable to brick buildings as to stone. Many of their buildings could have been built entirely of brick and eminently architectural. Brick architecture does not proscribe the legitimate use of the marble shaft and entablature. On the contrary, the beauty of brick architecture is often enhanced by the employment of other materials. We do not object to the use of columns in the walls of the theater of Marcellus or in the Colosseum. The forms would be as good architecturally if all, save the columns and entablature, were of brick. Brick and marble have ever been employed together in the best periods of art. One assists the other. The use of the classical orders with a small material like bricks has been criticized on the ground that a brick building requires a system employing small blocks and should adhere to arched forms. This is logical and perhaps quite true. Its carrying out, however, would so limit the employment of bricks in our architecture that we must waive this objection, as we are obliged to do in many cases where esthetic questions run counter to positive requirements. We must not forget that architecture is the art, which taking up and admitting as conditions of its working the necessary and common uses of the building, must nevertheless impress on its forms certain characters dignified and beautiful.



The later Renaissance architects have produced good results in brickwork based on Roman buildings. From these ruins they learned to compose monumental forms. Bricks have been used in all styles of architecture in the Lombard of North Italy, the Renaissance of all countries, also in Gothic and Saracenic. These represent periods where brick architecture acquired the dignity of a style; where the ornamentation of brickwork arrived at that state of usefulness which permitted architects to use it in quantity. Plain bricks have ever been in use by all civilized nations, but it was only when a practical ornamentation of this material came into use that there was a brick architectural style as instanced by the North Italian and North German churches.

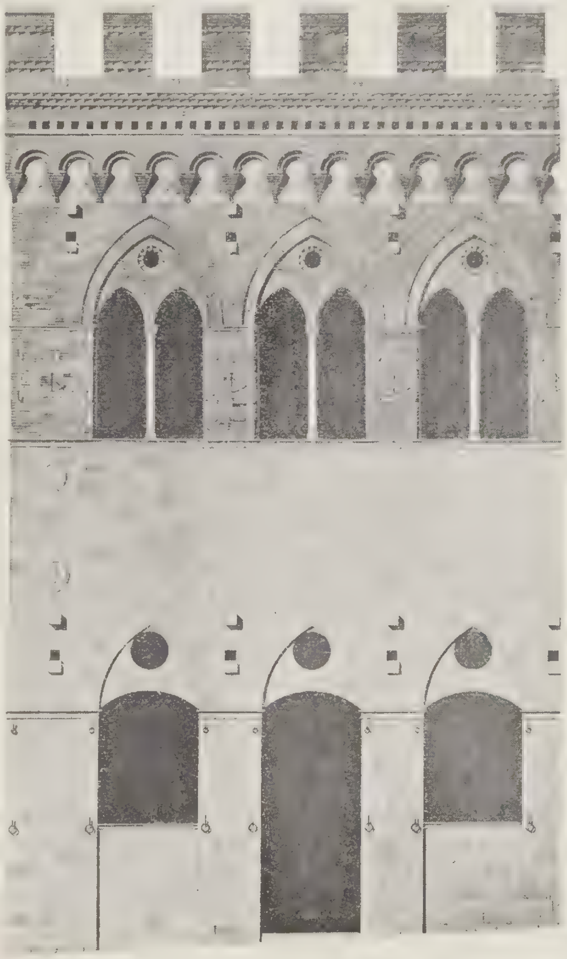
Architects should appreciate our own possibilities in brick architecture. It is only within the past few years that concerns like the Philadelphia and Boston Face Brick Company have made it practicable for architects to use Renaissance ornamentation to any extent in modern buildings. With many colored clays and a wide range of Renaissance forms, our brick architecture should equal if not rival in elegance the historic styles.

A well-studied composition, then, should not suffer for the lack of material, both in color and ornamentation, to make it at once elegant and refined. The study of composition of mass of a building is begun in one's student days and continued on through later practise. There are usually such a variety of conditions which seem to control the disposition of a modern building in silhouette as well as in plan, that perhaps the study of precedent is the most satisfactory way of acquiring a correct judgment of proportion as well as an acquaintance of suggestive solutions of difficult problems. A modern architect who has to deal with such a diversity of conditions should know all that historic precedent can teach him. As one of the dignities of architecture is its historic use, and since the latter is partly dependent upon its consistency of style, it would seem right to retain, as far as may be, the historic forms of the style adopted. The study of precedent is improving, each period of architecture supplying some valuable data. From ancient Rome we receive inspiration from imposing masses, great vaults and arches ("*Canina-Architettura Antica Romana*"). Vignola, Palladio, and the Tuscan architects found a rich field of suggestion in ancient Rome. Italy and Spain have produced many examples which were inspired primarily by ancient Roman work. Many buildings in Viacenza, by Palladio, would not look out of place in Rome. The Bourse and the Palace of Justice in Saragossa have quite the spirit and feeling of old Rome, with the bigness of scale and simple composition, most impressive and desirable qualities in architecture. Bruneleschi's dome is another of the results of careful studies of Roman ingenuity. Who is not impressed by the majesty of the great vaults of Constantine's Basilica, or by the ruin of the Baths of Caracalla?

After a study of Roman architecture an architect will strive for larger conceptions, he will realize that grand and simple forms are vastly more telling than any quantity of surface ornamentation. The arch is the legitimate form with which to span an opening with small materials, and there is no place like Rome for the study of its treatment.

We learned from ancient Rome the value of monumental architecture. It is, perhaps, from later styles that a more direct help of a different sort is to be had. There is a quaintness and interest in the brickwork of the Basilican churches with round campanile of Ravena. The numerous Italian churches and brick towers of a still later period furnish an inexhaustible field of suggestion in composition and grouping. Descriptions of these buildings are not a fruitful source of help. A study of them on the spot is the ideal way of getting the greatest good from them. Illustrations must be made to serve in many cases, and these have been multiplied until there is abundant opportunity to study precedent and to supplement observations made abroad and at home.

It is desirable, in acquiring a knowledge of composition, to be conversant with the theories which have been formulated from the study of past successful buildings, and supplement this study by a discriminating and thoughtful study of precedent. If a designer would occupy his evenings at home sketching the acknowledged good buildings, illustrations of which are easily accessible in books and photographs, he would find that greater facility with his pencil, as well as much acquired sensitiveness of feeling for composition, would result.



PALAZZO GROTANELLI, SIENA.

There has been much variety in the use of bricks. In Assyria, they were used in walls, piers, and in arches sparingly, the openings being generally spanned with stone or wood. Here the art of brickmaking reached its highest degree of excellence. The remains of glazed brick in colors are one of the most interesting and beautiful productions of art in the past. The fragment of wall, now in the Louvre collection, built of enameled bricks with lions in merely low relief in rich and most harmonious colors, should be an inspiration to artists.

Italian architects from the eleventh to the fifteenth centuries perfected a style of brick architecture which is most interesting and worthy of careful study and imitation. (H. Strack, "*Zeigel Bauwerke des Mittelalters und der Renaissance in Italien.*") It is an excellent brick style which we can properly adapt to our own uses in developing our architecture. The early work of this period was strictly a brick style of building, stone being used only in such exposed positions where brick would not last, as for copings and sills stone columns and caps and bases were employed. Cornices were generally of brick; sometimes the wood rafters project to carry the protecting roof of tiles. Often a stone base or entire stone story is given to these buildings, with smooth face and horizontal courses varying in height. The masses of these earlier buildings do not lend themselves readily to our modern requirements. But there is the right sort of feeling of robustness, together with refinement, which one welcomes in external architecture, and a study of this medieval brickwork is intensely improving. Siena, S. Gimignano, Bologna, and other Italian cities are rich in examples of this period of buildings. Later, the buildings become more elegant, ornate moldings and patterns are stamped on the bricks, as seen in Piacenza and Cremona (Gruner), a truly artistic and logical treatment in brickwork, at once elegant, refined, and dignified.

Terra-cotta and marble were soon combined with brick, and developed into the rich and beautiful brick and marble architecture for which this period of art in Italy is renowned. Profuse in ornamentation and glowing with color, it is full of suggestiveness for our own architecture. (Gruner's, "*Terra-Cotta Architecture*"; Street's "*Brick and Marble Architecture of Northern Italy.*")

ENAMELED BRICK OR CEMENT?

UNDER the above heading in the issue of September, 1895, THE BRICKBUILDER urged the desirability of using enameled brick as a lining for the subway which is now being built in Boston. A recent inspection of the partially completed works shows that the position taken at that time was a correct one, and that the cement which is being used as a lining for the walls of the subway will prove neither satisfactory nor economical in the long run, without some form of expensive surface treatment. The work is, at present, in too unfinished a condition to predict absolutely the final conditions, but it is quite manifest that the cement will not only be dingy in appearance, but in view of the quantity of moisture which seems to be condensing on all the walls, it is hardly likely that the cement will stand as well as a vitreous surface. The cement absorbs water and consequently accumulates dirt. It is much more liable to sweat in extremes of weather, and the resulting moisture is of a character which is properly taken care of only with extreme difficulty. It is not yet too late to make a change and employ glazed bricks throughout, though their use at this stage of the work would necessitate considerably more expense than would have been concurred had they been decided upon in the beginning. The subway is too important a work to be slighted in any respect, and consideration of mere present economy ought not to weigh as against durability and a bright, cheerful appearance. Very few underground tunnels are pleasant to travel in, and anything which would contribute to making them lighter and more cheerful in aspect ought to be adopted. It would seem now as if the best procedure would be to line up all the walls with enameled brick, set off with an air space between back of the brick and the present cement facing so as to check in a very large degree the accumulation of moisture by sweating on the surface of the wall. This construction would give a bright, thoroughly clean appearance, and would go far towards offsetting the forebodings which we sometimes hear expressed that the subway will be unfavorable to the people because of its gloomy aspect.

ENGINEER.

AN occasional visit by draughtsmen to some well-established terra-cotta or brick plant would be the means of getting much valuable information on the subject and methods of clay manufacture. It has become popular in some localities to organize parties for this purpose, and such visits are always encouraged by the manufacturer.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

EXPERT FIRE-PROOFING ENGINEER.

IN the last number of THE BRICKBUILDER was published a communication from one of our correspondents, calling attention to the fact that there is no generally recognized authority in this country on fire-proof construction, and suggesting that an expert fire-proofing engineer would not only fill a long-felt need, but would find ready employment for his talent in connection with our large commercial buildings. This thought is so manifestly in the line of progress that we hope it may stimulate some active, energetic young man to prepare himself, by study and experience, to understandingly and properly advise our architects and constructors as to the possibilities and limitations of fire-proof construction. An expert of this description, entering, as he would, upon comparatively untrodden fields, would have his own career to work out. It would perhaps be easier to say what he should not be, rather than to definitely prescribe his functions. He need not be an architect, though he should certainly have a very considerable architectural training, such as could be acquired only by observation of existing structures, and by intercourse with leading architects. He need not be an engineer by training, though he should have sufficient familiarity with the analytics of construction to be able to calculate in advance the strength of known mediums of building construction. The amount of mathematical training which is necessary for even the most extended architectural computation is in reality so slight that our fire-proofing engineer would not be called upon to be an expert mathematician. Nor need he be necessarily a builder; any more than an electrical engineer is necessarily obliged to serve an apprenticeship as a lineman. Our technical schools are full of bright, active, energetic young men, who are looking forward to winning a career for themselves. Architecture as a profession is rapidly becoming very much overcrowded, and advancement therein is in many cases a matter of personal influence and family connections. Civil engineering is a profession in which rise is very slow, and initial remunerations inadequate to the extensive preparation required. But if some young man, who, we will say, has completed the course in architecture at one of our technical schools, should give himself for three or four years to an earnest, exhaustive study of existing fire-proofing methods, including the practise not only throughout the length and breadth of this country, but also in Europe, and should acquaint himself thoroughly with the processes and capabilities of manufacturing fire-proof materials, he ought to be able to assume intelligently the position of consulting engineer for fire-proof work. The field to be covered in preliminary studies is not so large nor so varied but that our prospective engineer could cover it within the limits of, at the most, four years, and we at this moment know no professional opportunity which would be more sure of immediate pecuniary and personal returns than the line we have indicated. Fire-proofing is more of a study in this country than anywhere else, and we believe it is safe to say that in its most successful aspects it has achieved more success here than anywhere else. In certainly no other country has terra-cotta in its various forms been used so successfully to protect the elements of construction from the effects of excessive heat, and surely in no other country are the necessities of fire-proof construction so imperative. We call attention to our correspondent's letter and to these suggestions, in the hope that it may influence some young man to grapple with the problem, and by proper associations and experience become fitted to fill the want which we feel quite sure exists, and to apply the same species of scientific reasoning and deduction to fire-proof construction which has been so successful in the lines of electrical and steam work.

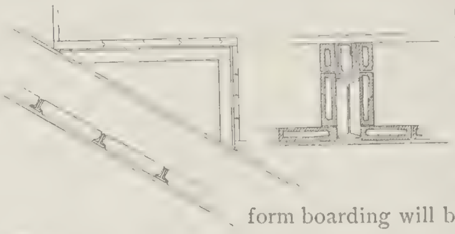
EDITOR OF THE BRICKBUILDER.

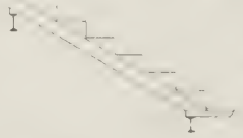
Dear Sir: — May I ask for some information? I am making plans for a public hall in this city, which it is proposed shall be fire-proof throughout in every respect. I want to use as little wood as possible in the finished construction. The distance between the beams is 2 ft. at the lower support and 3 ft. 9 ins. at the upper, the clear spans from girder to girder lengthwise being 15 ft. I enclose a diagram showing a plan of the beams. How can I best fire-proof these? These platforms are each 2 ft. 6 ins. wide, are to be level, and are to be floored with 1½ in. pine plank. The ordinary terra-cotta flooring blocks would not be practicable in this case, on account of the beams not being parallel and being set on a pitch, and I am at loss to know what is the best way to effect this construction.

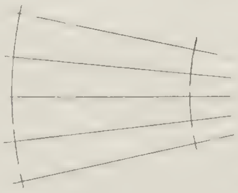
What is the custom in Boston in regard to fire-proof stairways? I have noticed in Chicago that the stairs are usually built with iron stringers and slate treads, none of the iron being protected. As I understand it, one of the fundamental principles of fire-proof construction is that no structural metal work shall be exposed to the action of fire. Should the stair stringers not be protected in some way, and if so, what is the most practicable manner?

MILWAUKEE, April 10, 1896. S. J. C.

THERE are very few theaters so constructed as to afford proper security for the steel work of the sloping gallery beams. As our correspondent states, the ordinary floor blocks are not suitable. A better way is to fire-proof the floor with a species of roof construction, light T irons being suspended underneath the beams in concentric lines, and serving as supports for 2 in. or 3 in. book tiles which can readily be fitted to the warped surfaces. The webs of the beams can likewise be protected by light terra-cotta work. It is presumed that the platform boarding will be supported on brackets bolted to the top of the beam. The terra-cotta work can then be carried up to the under side of boarding, in each case leaving air spaces between each beam. This would probably be the least expensive method and would be sufficiently fire-proof for all purposes, especially if each air space is stopped off at intervals of 8 or 10 ft. This construction is shown by the diagram. Or, another method may be employed, involving somewhat more cost and a considerably heavier floor, but more durable in its character. The book tiles are put in as before and the spaces between the beams are filled with concrete made of cinders, so as to be as light as possible. The treads and risers of the platforms are then formed in concrete, finished smooth with cement, and the boarding is applied directly to the concrete without nailing, being held in place by a layer of asphalt or one of the compositions used for that purpose now on the market. In this construction the beams are entirely encased, there are no air spaces, and no possibility for spread of fire.







In regard to the staircases, the custom very generally is not to fire-proof them. This does not seem to us either logical or consistent. The stringers can be lathed underneath with metal lathing, and plastering applied of sufficient thickness to protect the ironwork. A better way, however, is to adopt the same construction indicated for the gallery beams, filling in between the stringers of stairs with terra-cotta resting on transverse T irons, and filling over the blocks with cement concrete, so that the slate treads will bed directly upon the cement. — ED.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Continued.*)

THE CHEMISTRY OF CEMENTS.

NUMBER 15 of the table of analyses is selected for the next illustration.

As in the preceding table the inert matter is deducted, and the active ingredients are calculated to hundred parts, and placed in column No. 1.

No.	1	2	3	4	5	6	7
Silica . .	22.61 —	4.72 =	17.89 —	16.63 =	1.26 —	1.26 =	0.00
Lime . .	62.15 —	8.80 =	53.35 —	31.00 =	22.35 —	2.35 =	20.00
Magnesia	3.14 —	3.14 =	0.00 —	0.00 =	0.00 —	0.00 =	0.00
Alumina .	12.10 —	2.68 =	9.42 —	9.42 =	0.00 —	0.00 =	0.00
Totals .	100.00	19.34		57.05		3.61	20.00

Trisilicate of lime, magnesia, and alumina	19.34	
Bisilicate of lime and alumina	57.05	
Silicate of lime	3.61	
Percentage of silicates . . . . :		80.00
„ „ uncombined base		20.00
Total		100.00

The following is an analyzation of analysis No. 20 of the table of analyses.

The non-essentials being discarded, the analysis in hundred parts appears in column No. 1.

No.	1	2	3	4	5	6	7
Silica	28.96—	15.87=	13.09—	00.54=	12.55—	11.03=	1.52
Lime	51.16—	29.58=	21.58—	01.00=	20.58—	20.58=	0.00
Magnesia . . .	10.89—	10.53=	00.36—	0.36=	0.00—	0.00=	0.00
Alumina . . .	8.99—	8.99=	0.00—	0.00=	0.00—	0.00=	0.00
Totals . .	100.00	64.97		1.90		31.61	1.52

Trisilicate of lime, magnesia, and alumina	64.97	
Bisilicate of lime and alumina	1.90	
Silicate of lime	31.61	
Percentage of silicates		98.48
„ „ uncombined matter		1.52
Total		100.00

The analysis of a raw cement stone being given, and it being desired to reduce it to the percentages of silicates, which would appear after calcination, the following will be found an easy method for making the calculation.

Analysis No. 40 in the table is that of a raw cement stone, as will be seen in the reference table. The carbon dioxide was subtracted from the calcium carbonate for the sake of convenience in placing it in the table. The analysis of the stone is given in column No. 1 in the following table.

No.	1	2	3
Silica	17.50	17.50	28.92
Carbonate of lime . . .	65.20	(lime) 36.51	60.34
Alumina	6.50	6.50	10.74
Oxide of iron	3.00		
Water and loss	7.80		
Totals	100.00	60.51	100.00

Column 2 contains the essential constituents, the carbonate of lime being reduced to lime. By reference to the table of chemical combinations, it will be seen that carbonate of lime is composed of lime, 56, carbon dioxide, 44; therefore 65.20 × 56 = 36.51 lime.

The essential constituents, as shown in column 2, are reduced to hundreds in column 3, and is shown in column 1 of the following table.

No.	1	2	3	4	5
Silica	28.92 —	18.95 =	9.97 —	9.97 =	0.00
Lime	60.34 —	35.34 =	25.00 —	18.58 =	6.42
Alumina . . .	10.74 —	10.74 =	0.00 —	0.00 =	0.00
Totals . . .	100.00	65.03		28.55	6.42

Bisilicate of lime and alumina	65.03	
Silicate of lime	28.55	
Percentage of silicates		93.58
„ „ uncombined		6.42
Total		100.00

Should carbonate of magnesia appear in the analysis of a cement stone, the amount of magnesia will be found by multiplying the carbonate by .476, as shown in the table of chemical combinations, and the product is placed in the column of constituent parts, as was done with the lime in the preceding table.

The following analyzations are taken from the corresponding numbers in the table of analyses, and reduced to hundred parts, the analysis appearing in column No. 1.

No. 47.

No.	1	2	3	4	5
Silica	21.48 —	13.71 =	7.77 —	7.77 =	0.00
Lime	70.75 —	25.57 =	45.18 —	14.48 =	30.70
Alumina	7.77 —	7.77 =	0.00 —	0.00 =	0.00
Totals	100.00	47.05		22.25	30.70

Bisilicate of lime and alumina	47.05	
Silicate of lime	22.25	
Total silicates		69.30
Free lime		30.70
Total		100.00

No. 48.

No.	1	2	3	4	5	6	7
Silica .	22.35 —	1.76 =	20.59 —	9.99 =	10.60 —	10.60 =	0.00
Lime .	69.82 —	3.28 =	66.54 —	18.63 =	47.91 —	19.76 =	28.15
Magnesia	1.17 —	1.17 =	0.00 —	0.00 =	0.00 —	0.00 =	0.00
Alumina	6.66 —	1.00 =	5.66 —	5.66 =	0.00 —	0.00 =	0.00
Totals	100.00	7.21		34.28		30.36	28.15

Silicate of lime, magnesia, and alumina	7.21	
Silicate of lime and alumina	34.28	
Silicate of lime	30.36	
Percentage of silicates		71.85
„ „ free base		28.15
Total		100.00

No. 50.

No.	1	2	3	4	5
Silica	22.56 —	14.15 =	8.41 —	8.41 =	0.00
Lime	69.42 —	26.39 =	43.03 —	15.68 =	27.37
Alumina	8.02 —	8.02 =	0.00 —	0.00 =	0.00
Totals	100.00	48.56		24.09	27.37

Silicate of lime and alumina	48.56	
Silicate of lime	24.09	
Percentage of silicates		72.65
Free lime		27.35
Total		100.00

No. 52.

No.	1	2	3	4	5	6	7
Silica	23.70 —	3.58 =	20.12 —	11.05 =	9.07 —	9.07 =	0.00
Lime	65.63 —	6.67 =	58.96 —	20.60 =	38.36 —	16.91 =	21.45
Magnesia	2.38 —	2.38 =	0.00 —	0.00 =	0.00 —	0.00 =	0.00
Alumina	8.29 —	2.03 =	6.26 —	6.26 =	0.00 —	0.00 =	0.00
Totals	100.00	14.66		37.91		25.98	21.45

Silicate of lime, magnesia, and alumina	14.66	
Silicate of lime and alumina	37.91	
Silicate of lime	25.98	
Percentage of silicates		78.55
Percentage free base		21.45
Total		100.00

The foregoing calculations sufficiently illustrate the system of calculating the percentages of silicates or active setting matter in a cement, or cement rock, from such analyses as are usually rendered by chemists and analysts. They also determine the classes of silicates which may be present and their percentages.

In a cement containing the three bases, lime, magnesia, and alumina, there may be found the three classes, namely, triple, double, and single silicates.

As has already been stated, a cement containing two or three silicates is superior in quality to that which contains but one.

To illustrate, let us suppose a cement to contain silica, lime, and alumina in exact combining proportions and forming a double silicate of lime and alumina, as in the following: —

Silica	29.14
Lime	54.34
Alumina	16.52
Total	100.00

Now if we take 8.00 from the alumina, and add an equal amount to the silica and lime in the proportions of 2.80 to the silica and 5.20 to the lime = 8.00, the new table will be formed as shown in column No. 1 below, and the double and single silicates will appear in the second and third columns respectively.

No.	1	2	3	
Silica	31.94 —	15.04 =	16.90	
Lime	59.54 —	28.04 =	31.50	
Alumina	8.52 —	8.52 =	0.00	
Totals	100.00	51.60	48.40	
Bisilicate of lime and alumina				51.60
Silicate of lime				48.40
Total				100.00

There can be no question whatever that a cement formed with the two classes of silicates, as shown in the latter table, will be superior in quality to that shown in the preceding table, which is due to the fact that in a cement, whether natural or artificial, lime is superior to alumina as a base, in the mortar of masonry or concrete, used either above or below water, and especially is this true in regard to masonry or concrete submerged in sea water.

No better demonstration of this fact is afforded than in the use of Tiel hydraulic lime, which contains less than 2 per cent. of alumina. Although this material contains a large percentage of uncombined lime, it has never been surpassed in its ability to resist the action of sea water, and those cements which have failed in sea water, whether natural or artificial, are found to contain a large proportion of alumina. Therefore, as shown in the last two tables, the alumina may vary 50 per cent. in amount, and still remain within the limits of true combining proportions, yet it is extremely probable; and further, it may be stated as an absolute certainty, that as between the two compositions referred to, the latter would, while the former would not, sustain continued immersion in sea water.

It seems desirable that some explanation be made or reason given for the position taken in regard to the combining ratio of the various silicates. To make a concise statement of the conflicting opinions concerning this vexed question, it is best to give them in the order in which they predominate.

First. Hydraulic cement is produced by the formation of silicate and aluminate of lime during calcination. Magnesia, if present, is inert or uncombined.

Second. By the formation of bisilicate of lime and alumina during calcination, magnesia, if present, forms silicate and aluminate of magnesia.

Third. The formation of silicate of lime during calcination, the alumina and magnesia remaining uncombined, or playing an unimportant part.

Fourth. That after calcination the constituents, silica, and whatever bases may be present, exist in a free state, and that by the application of water, a silicate is formed combining all the bases present in certain proportions; the excess, if any, is uncombined.

Fifth. Whether the material is natural cement rock or is artificially compounded, the formation during calcination of triple, double, and single silicates (dependent on the number of bases present), in certain fixed proportions, and any excess, whether of silica or the bases, remaining uncombined.

The preceding chapters, the table of chemical combinations, and that of combining ratios, is sufficient evidence of our belief in the correctness of the fifth proposition, and it is but just and proper to state that we are substantially alone in this belief.

The nearest approach to it is the opinion of Professor Cox, who, however, as shown by his writings, inclines to the fourth proposition.

Without wishing to arrogate any special knowledge of the art, or to attempt the building up of a new theory in relation to the chemical combinations existing in a cement, or contradictorily oppose the views of others on this subject, yet it is due to state that we find it impossible to accept many of the opinions given, such, for example, as that both silicate of lime and aluminate of lime are formed in a cement.

While it is true that aluminate of lime can be, and is, formed by the action of heat when these constituents are treated separately, that it can so form when in the presence of silica and lime, we do not believe.

We have already shown that alumina has both a basic and acidic character, although both are comparatively weak; and we believe that its acidic character entirely disappears when in the presence of the much more powerful silicic acid, and that when in the presence of that acid it can only assume the properties due to its basic character, and it therefore combines with silica in certain fixed proportions with lime and magnesia; and therefore when these three bases are present, with silicic acid, a combination is formed by the acid and the three bases in fixed and unalterable proportions, in accordance with the law of atomic weights.

There can be no doubt that if a mixture should be compounded which contained a small amount of silica and a large amount of lime and alumina, the excess of the two bases over and above their equivalents of silica would combine, forming aluminate of lime.

But inasmuch as that there are no known cements, whether natural or artificial, which contain alumina in excess of its combining ratio with the silica and lime present, it is needless to pursue this subject further.

That magnesia can remain uncombined when present with silicic acid and lime, or lime and alumina, is a theory which has been so often disproved, that it seems incredible that advocates of this fallacy should be found among the higher authorities, who claim that in an artificial cement more than three per cent. is not to be tolerated, while in natural rock cements it is uncombined, and therefore inert.

The Rosendale cements, which, in quality and general excellence, stand in the front rank among American rock cements, contain from 15 to 18 per cent. of magnesia. These cements are never hydrated, being packed at the mill spout as fast as ground; and when used, are taken from the packages and mixed with sand and water, and immediately applied in masonry or concrete.

If the magnesia in these cements is in a free and uncombined state, as claimed by many writers, it must certainly follow that in the subsequent hydration, expansion and disruption of the masonry is inevitable. And so, if these cements are kept in packages any length of time, say three or four months, as often occurs in the hands of dealers in cements, the hydration of the free magnesia would certainly expand the packages and burst the hoops. And yet this distension of packages never occurs, and the idea of a disruption of masonry through the use of Rosendale cement is simply absurd. The millions of barrels of this brand of cement used in many of the greatest engineering and architectural works in the country, such as the high bridge over the Harlem, the New York and Brooklyn suspension bridge, the Croton aqueducts, the tallest buildings in lower Broadway, — in short, it may be said that New York and Boston are built with his cement, — and furthermore, the Akron, Milwaukee, Utica, and Mankato brands of cement, all contain practically as much magnesia as do the Rosendale brands; and yet there is no known instance of any of these brands ever expanding in masonry, and magnesian cements are used in this country to the extent of nearly five million barrels yearly. These facts alone stand as a complete refutation of the absurd theory that magnesia is free in these cements.

(*To be continued.*)

CONSUMPTION OF PORTLAND CEMENT IN AMERICA.

THE following statement, taken from the "Mineral Resources of the United States" recently published, speaks for itself: —

	1891.	1892.	1893.	1894.
Production of Portland cement in the United States.	454,813 bbls.	547,440 bbls.	590,652 bbls.	798,757 bbls.
Imports	2,788,313 "	2,440,654 "	2,674,149 "	2,638,107 "
	3,443,126 "	2,988,094 "	3,264,801 "	3,436,864 "
Exports	— — —	21,536 "	14,276 "	9,725 "
Total consumption	3,443,126 "	2,966,558 "	3,250,525 "	3,427,139 "
Percentage of total consumption produced in the United States	13.2%	18.4%	18.2%	23.3%

"From the above table it appears that the importation of cement into this country has remained nearly stationary since 1891, and that the domestic product has gained rapidly in comparison with the imported, until, in 1894, nearly one quarter of the Portland cement used was of American manufacture."

Of this 798,757 barrels produced in this country during the year 1894, 80 per cent. was manufactured in Pennsylvania, New Jersey, and New York.

Pennsylvania	437,106 bbls.
New Jersey	72,223 "
New York	117,275 "

The output of the Pennsylvania factories for 1896 will be double that of 1894.

One of the reasons given in this issue of the "Mineral Resources of the United States" for this great increase in the use of American Portland cement, was owing to the fact that it costs fifty cents per barrel less than the foreign cement. While this may be the case at some of the small Western mills located at interior points, where the freights are high from the coast, this reason will not answer for the cement manufactured in the East.

The writer knows from personal experience that cement made by leading German cement manufacturers is laid down at Philadelphia, New York, Boston, and Baltimore from ten to twenty cents per barrel less than standard brands of American Portland cement sell for in the same market, and the bulk of the Portland cement manufactured in this country, being made in the eastern part of Pennsylvania, Central New York, and New Jersey, finds its largest market in the large Eastern cities, where even the best grades of foreign cement frequently undersell them.

The freight rates from Pennsylvania and New Jersey factories to interior points, such as Detroit, Chicago, Milwaukee, and Duluth, were higher during the year 1894, by about ten cents per barrel, than the freights to such points on foreign cement from New York, and to St. Louis, Kansas City, Denver, and Salt Lake City, the foreign cement had an advantage in freight of twenty-five cents per barrel. So it can be seen that it is not because American Portland cement is sold cheap that its adoption is becoming so general all over the country for first-class engineering work; but its use is due entirely to the fact that the American product is, in most cases, superior to the foreign, and many engineers and architects prefer to use material manufactured at home, where they come in direct contact with the producer, and can hold him responsible for the character of the goods shipped.

Of the foreign countries shipping any large quantity of cement to the United States, that which comes from Germany alone can rank with the bulk of the American product for fineness, strength, and durability. Germany produced 12,000,000 barrels of Portland cement in 1894, and exported 2,400,000 barrels, of which a little less than 1,000,000 barrels came to this country. The fact that there was almost as much American Portland cement as German Portland used in the United States in 1894 will be a surprise to many who have been inclined to belittle the American Portland cement industry. These figures show that Germany consumed nine and one half million barrels of Portland cement in 1894.

With the adoption of concrete, which is fast becoming general for all classes of work in this country, it may not be rash to predict that the consumption will reach 10,000,000 barrels per year in the near future.

WM. G. HARTRANFT.

EDITOR OF THE BRICKBUILDER.

Dear Sir: — We are desirous of getting for use in half-timbered work a cement that will, after setting, be something near a creamy-white color.

If this color is not obtainable in cement in its natural state, what stain could be used that would be durable?

POUGHKEEPSIE, N. Y. SUBSCRIBER.

WE should be glad to acquaint "Subscriber" with the address of any manufacturer whose product would meet these requirements. — *Ed.*

REPLYING to a correspondent who has had difficulty in making a cement sidewalk retain a smooth surface, a writer in *Paving and Municipal Engineering* says: —

"While the top mixture should be thoroughly rammed or beaten and well troweled, yet this treatment should not be continued so long as to bring to the surface a considerable quantity of neat cement, thus leaving the layer of mortar next below without sufficient cement to bind it together. If this is done, the thin layer of neat cement may flake off when set, revealing a layer of almost clear sand below. A similar result obtains if one attempts to retrowel a surface once finished and partially set but afterward defaced. Sprinkling the walk before the cement has thoroughly set may cause blisters which mar the appearance of the work; on the other hand, the walk should be protected from the direct rays of a hot sun, or surface cracks may result."

THE following rules for the use of cement in freezing weather will be found useful: —

As little water should be used as will permit a thorough incorporation of the materials.

The water, sand, and stone may well be heated to about 100 degs. F., and in any case should be above 32 degs. F.

Salt may be used in small quantities to delay freezing until the work is in place, or in larger quantities to prevent freezing until the cement has set and hardened sufficiently to resist the destructive tendency of the freezing weather. — *Municipal Engineering.*

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

PRELIMINARY ESTIMATES.

THE first meeting of the architect and contractor on a given problem is usually for the purpose of making preliminary estimates. Although this work is informal, that is to say, not binding on the different parties concerned, it is none the less an important step in all building operations. Almost all mercantile structures, and many others, as theaters, hotels, and apartment houses, must be so designed and constructed that they will pay a certain percentage on the amount of capital invested. Once in a while it is true some wealthy individual undertakes, as a matter of personal pride, to erect a structure regardless of cost, and some of the insurance companies and rich corporations have done the same thing for the purpose of advertising, but these are exceptions to the general rule that such buildings will not be built unless they are profitable investments. The same limitation exists, but not so rigidly, in the case of public works, for these must usually be so planned that their cost will fall within such appropriation as may be available for the purpose. Church work comes under the same general rule, while domestic architecture has a less restriction in the amount which the owner thinks he ought to spend to satisfy his requirements. It is easy to see that the financial question is most important in the case of mercantile work, for the sole reason for its existence is that it may be a source of revenue to its owner; not that artistic considerations do not enter to a certain degree into the most prosaic commercial problems, but only incidentally. The matter of preliminary estimates is important but in a different way in the consideration of large public work, for in the first place the return in this case cannot be figured in dollars and cents, for in such work a considerable expenditure is necessary, and usually entirely justifiable to give the building proper architectural dignity, and to afford liberal and attractive accommodations to the legislative bodies and executive officers as well as the general public.

Important public work should be conceived and executed on as liberal scale as possible without waste or extravagance. It would be perfectly possible, for instance, to build a public library which would look like a mill on the exterior and barracks on the inside — no doubt books might be safely housed in such a structure, and the patrons and attendants might carry on their respective work in such a place free from physical discomfort, but no enlightened community would be likely to erect such a structure; if a building of that kind was proposed, we should at once hear people say that it would not pay, not meaning, of course, that it would not give a greater space enclosed within the four walls and roof than if the structure was laid out on a more liberal scale, but that there are other things to be considered in such a problem than simply to get the biggest thing for the least money. Of course in public works where utility or usefulness is the essential feature, as in the case of the various pauper and criminal institutions, hospitals, and the smaller municipal work, the financial limitations necessarily exist, as in the case of mercantile enterprises, but when the problem is a State capitol, a city hall, a court house, or a building of a similar character, then the people should be led in some legitimate way to appropriate enough money that the result may be worthy, not only from an architectural standpoint, but as setting forth the liberality and public spirit which should be found in the citizens of all progressive and enlightened communities.

We can thus see readily that preliminary estimates are necessary in almost all building projects, but for two distinct reasons: in the case of mercantile work to determine whether the proposed work is practicable; in that of civic and domestic work, to determine how much money will be required to carry out the problem in a satisfactory and proper manner.

Having now considered the objects of procuring preliminary estimates, let us look at the various methods of obtaining them, beginning with the most indeterminate cases.

Suppose there is a piece of land possibly covered wholly or in part with buildings, which yields under existing conditions a certain revenue, but there is reason to suppose if new buildings were erected the return would be considerably increased. Before undertaking the improvement of the property and running the risk of losing a certainty with the chance of doing no better even with a greater invested capital, the owner naturally wishes to know, first, the amount of expenditure which will be involved in the project, and then the essential facts, such as available area, etc., which will determine to a large extent the rental value of the improved property. Such a problem is usually studied, often before even sketches are drawn, by means of comparisons. Such comparisons were formerly almost always made by figuring the cost of buildings of similar classes at so much per square foot on the ground, but of late years the cubic unit is more universally employed, which gives quite accurate results, particularly in the case of large mercantile structures, involving no unusual structural or artistic complications, and for all practical purposes this method has proved to be accurate enough to obtain close approximate figures. To arrive at satisfactory results under these conditions it is necessary at the outset to adopt some uniform method of considering such matters as areas, light wells, and roof spaces, particularly if the figures used for executed work are taken from books or reports, for there are many different ways of estimating the relative cost of such unoccupied space, compared with the cost of the building proper. Care must also be taken to compare only buildings of a similar class; that is to say, where, in general, the construction, materials, and general scheme of architecture are identical both in the executed and proposed work. Such estimates are often made by the architect alone, but it is well to have the practical experience of a reliable contractor as well, and care must be taken to determine if the work under consideration can be carried out under the same conditions as that with which it is being compared. Locality and time often make a great difference in the relative cost of materials, and building laws sometimes require much more expensive construction in one city than in another; it is also unwise to compare the cost of buildings erected under different acts in the same municipality, as most of the laws are being constantly revised and made more stringent. The matter of insurance has of late become an important factor in the intelligent consideration of building projects. Not only have the regulations and inspections of the underwriters been made much more rigid and far-reaching than formerly, but a careful study of rates will often show that it will be more profitable in the end to erect a structure of higher grade or to adopt certain precautions against fire, which at first sight might seem unprofitable or undesirable. The season of the year at which the work is to be carried on, and the rapidity with which it is to be prosecuted, are also matters which effect in no small degree the relative cost of buildings; so it can be readily seen that this comparative method must, after all, be used with considerable judgment, and a full and accurate knowledge of the attending conditions if accurate results are to be reached. The matter of fixtures, that is to say, heating and ventilation, plumbing, elevators, and electric work, has become such an important item in the cost of a modern structure of any size, that it is well, even in preliminary work, to have such matters looked into in a general way by experts, and to have the assurance from them that the problem at hand calls for unusual expenditure in this direction which has not been considered.

The next stage in the development of a building project at which approximate estimates are usually obtained is after preliminary sketches have been made by the architect. The amount of definite knowledge which drawings under this title should convey is practically essential to form a reasonably accurate idea of the cost of any structure where the construction, the plan, and the artistic treatment are not all of the most simple and straightforward type.

It is therefore necessary, in the case of most public buildings and domestic work on any extensive scale, to obtain preliminary estimates under these conditions, for such problems vary one from another in so many important respects that the comparative method in itself is seldom accurate enough. It is still used, however, but in rather a different way and to a greater advantage here by the contractor than the architect. In this instance, after an examination of the sketches, the contractor makes a comparison of the proposed work as outlined with some existing building, the cost of which is known, and then by a comparison of superficial area or cubical contents arrives at an approximate figure. But this method is more often used merely as a check to the more definite result obtained by taking off the quantities from the drawings as accurately as possible and then figuring the cost in the same manner as would be done from complete working drawings, but, of course, without the absolute accuracy which could be obtained from them. Under this method there are many opportunities for the misunderstandings which so often occur in preliminary estimating, and which both the architect and contractor must be careful to guard against.

The difficulties which are encountered are briefly these: The owner, being desirous of keeping the architect within reasonable financial bounds, usually names as his limits the minimum price for which he thinks the work can be done. The architect, desirous of "nursing" his client, often assures him that the building can be built for the sum named, and, finally, the contractor in his turn, anxious to please both parties and feeling that any encouragement on his part will tend to put a new piece of work on the market, comes forward and agrees to figures and prices which his experience should have taught him cannot be lived up to when it comes to actually undertaking the work at hand.

Another important consideration which must be taken into account when making preliminary estimates is, that due allowance must be made for the natural expansion and elaboration of the problem which always occurs as the work develops, the responsibility of which is usually shared in common by the client and the architect. In presenting preliminary estimates to a client, it is necessary, if misunderstandings are to be avoided, to state just what is included and to what state of completion the building is carried. For instance, in the case of a public building, it should be specified whether or not the figure includes any allowance is made for decoration, sculpture, fixtures, or furniture which the client may consider, and with reason, are a constituent part of the building, but which the architect or the contractor, on the other hand, may have looked upon as after considerations. An important item which is often overlooked, strange as it may seem, is that of the architect's commission, and the total cost of more buildings than one would suppose it possible has been figured with the omission of this important item.

It is true, many architects and contractors justify in a measure preliminary estimates which are misleading, on the ground that if the truth were told at the outset, the figures would discourage the client from going on with the work, or that he would leave the architect who has been bold enough to present things in their true light and go to some one who would be willing to assure him that impossibilities can be accomplished. Though it must be admitted that after putting before a client estimates which have to be doubled or tripled before the work is completed, he is led by easy stages to spend in the end an amount he declared at first he would never assent to, it is, nevertheless, safe to say regarding preliminary estimates that honesty is the best policy, and if this principle was consistently followed by both architects and contractors, much of the feeling of distrust which now hovers over them would be dispelled and no one would suffer in the slightest; in fact, under existing conditions, other things being equal, those who state the facts to the best of their knowledge and belief come out best in the end.

In most well-conducted architectural competitions it is now customary to place some limits of cost on the proposed work by requiring the competitors to hand in with their drawings an estimate, signed by some responsible builder, which will represent the cost of the building. Of course, under these conditions, each architect gets the most favorable proposition possible, and as some contractors are much more obliging than others under such circumstances, if the matter of cost has been given as one of the factors which control the award, the judges should in all cases obtain estimates on all the designs under consideration made by the same person or persons, so that all competitors shall fare alike. In some competitions the estimate accompanying the drawings is required to be a *bona fide* bid from some reputable contractor, who agrees over his signature to build the proposed structure for the sum named. As such figures, however, are made up from what amount to mere sketches and outline specifications, besides the more important consideration that as a matter of fact no building is ever built without material changes from the competition drawings, the same opportunities for under-valuation exist as in the first instance, and therefore the same method of obtaining uniform estimates should be pursued as described above.

The ethics, or, to speak more plainly, the morals, involved in preliminary estimating are few and simple compared with those which arise in the more formal relations between the architect and contractor. As a rule, the time and experience which the contractor bestows on such work is given without compensation. To be sure, the familiarity which is gained by a thorough knowledge of a problem during the period of development and the insight into the various details of the plan and the construction which comes from constant consultations between the architect and contractor gives the latter a certain advantage over other competitors when it comes to making up the formal proposals. But, on the other hand, such knowledge often leads the contractor to be over-cautious, and, consequently, lose the job. And it is safe to say that for most of the time expended on preliminary estimating, the contractor receives no material return. It would undoubtedly be better if, on work involving any considerable amount of time and labor, the contractor could receive reasonable compensation; this would relieve the architect of a certain feeling of obligation and often a desire to show favoritism in making the final award. Under these conditions it may be assumed that the contractor would perform his work more thoroughly and conscientiously than at present, but the sentiment of the times which assumes that it is profitable and justifiable to get all one can for nothing will probably make it hard to institute a reform in this particular.

(*To be continued.*)

PLASTERERS' STEEL CORNER PLATES.

EARLY in the century men began to think about improving the corners of plastered walls. In looking over old buildings we find various attempts, all along the line, to strengthen the weakest part of the plastered walls. Numerous devices and expedients appear, showing the development of this thought for upwards of a hundred years.

Formerly corners were cased over with boards or molding. Then the English carpenters prepared a corner bead of wood, in form similar to the common picture molding, the top surface of the securing strip being chipped over to form clinches in the mortar. This was very generally adopted, and answered the demand in Europe and America until the advent of power machinery. Then came an overturn. The narrow lath took the place of the hemlock board, split and wedged apart for clinches, and the round rod displaced the corner bead.

Despite all that has been said against it, the rod is with us still, in common use, splitting the corner apart with two straight joints from top to bottom and shrinking away from the mortar in drying; everybody hates it; it is unarchitectural; the loose edges are always falling to pieces; the carpenter is unable to miter his finish up to it; the paper-hanger seldom covers it smoothly; the painter wastes time and putty vainly trying to repair and decorate an awkward and mean construction. The best that can be said of the rod is that it furnishes a good harbor for dust and vermin and comes cheap. To oust this thorn in the flesh of architecture seems very simple, but its place must be filled with something better than cement or stucco; something that is easily handled, quickly worked up to, that stays put, and costs but little.

The cast-iron corner came in and went out. The gas pipe was drilled and screwed up, but the plasterer shook his head.

The tinker stripped his metal, folded it over a small wire, bent the flanges and nailed them to the corner, but the labor and patience in making them straight and preserving the alignment while the plastering was in process was too much for the vantage gained. Moreover, all these methods split the corner apart when it should be united or clinched.

The urgency for something better than mortar or wood has suggested steel to many minds, but the difficulty of manufacture, the cost of material, the energy and capital necessary to produce and distribute the goods in small quantities over the country, have stood in the way of progress.

Sometime in the early sixties, George Corbett, of Pittsburg, Penn., received the first patent ever granted for a metal corner plate. He probably made little or no use of that, for in December, 1872, he received a reissue that appears more feasible.

Against this, however, there must have been at that time just three difficulties: The high cost of metal, the impossibility of a proper manufacture, and the scarcity of men with sufficient patience to put it into a building on a plumb line. The corner under mortar was a good one.

Then came George Pagels, of Baltimore, patent April, 1874, with a strip of sheet iron so cut and formed as to grasp both sides of the corner. The difficulty of applying such a strip to a crooked wall is easily seen; should the nail draw harder on one side than the other, it would draw the blade towards itself and curve the outline.

The next to see the importance of this art and to aid in its development was George Dacunha, of Montclair, N. J., whose patent, dated December, 1883, aims at every possible form of perforated and bended sheet iron corners. But at this writing it does not seem probable that any of his inventions will come into general use.

The last patent on the corner plate was issued to a man who had long been familiar with the trowel, and who foresaw the essential features necessary to success: that it should be easily and firmly applied to the wall; that it should add little or nothing to the cost of the building; that it should furnish ample clinching spaces for the mortar to bend round the corner and unite the two sides of the plastering, and that it should furnish a faultless outline for the plasterer to work to, enabling him to do quickly and carelessly the most tedious part of his work.

The first, and perhaps the most important, quality to its general use was accomplished by adding to the plate a thin strip of furring, to protect it in handling and furnish sound nailing in putting it into the building. This may also be made as required to suit the various thicknesses of lathing and plastering. But the most difficult part in the manufacture of the plate was to get a true line 10 or 12 ft. long on the edge of a thin steel plate, warped and twisted in punching away more than half the weight of metal, and this, too, having a lateral bend of 45 degrees. Machines were made, altered, and thrown out, experts sought far and near. Advice was cheerfully received, and experiments thoroughly tested, but not until more than two years had passed was a satisfactory plate brought out. This was done by the Hamblin & Russell Manufacturing Co., of Worcester, Mass., who are now turning out several thousand feet daily.

The wholesale agency in New York City is making sales of 50,000 ft. and upwards in different parts of the country, and the patent has been allowed in several foreign countries.

The great advantage seen in this invention by the property holder is in the perfection of outline and permanency of the plastered corner. The plain, square, solid structure receives the embellishment of paint, paper, or fresco with better effect than the more ornate work. But the plasterers, with economic eyes, can see a great saving of time, the essence of all things. And the architect is relieved of much care and anxiety.

The plate was taken into the nineteenth triennial fair of the Massachusetts Charitable Mechanics Association the day the United States patent was issued, and the judges there saw fit to award a silver medal.

It has also received the indorsement of many of the most sturdy and conservative builders, who predict for it a permanent place in architecture.

THIS steel corner plate is fully illustrated in the advertisement of G. W. Meserve on page xxxii. — *Ed.*

EDITOR OF THE BRICKBUILDER.

Dear Sir: — Reading in your paper the remarks upon the whitening of brick, I venture to make some observations, founded upon actual experiments and chemical analysis made by myself.

I have only found two kinds of efflorescence, one consisting chiefly of bicarbonate of soda, which is generally much the most profuse and large in quantity, and of almost snow-white color. This, so far from being caused by the use of cement, would be greatly diminished and probably entirely prevented by the use of cement in place of lime, for the following reasons: —

It is caused by the use of brick made on the shore, and, therefore, from salt and brackish clay. The burning of this clay results in the reaction of silica, or sand, upon the salt in the presence of products of combustion containing hydrogen. The reaction gives silicate of soda, which remains in the brick, and hydrochloric acid, which passes off into the atmosphere. The writer has observed this acid in large quantity when passing such brick kilns. The bricks now containing silicate of soda in small quantity would not effloresce until laid in the wall, and would not effloresce even in the wall unless the mortar were alkaline; but in the latter case, which is, of course, much more common, the lime reacts upon the silicate of soda, forming caustic soda, which is very soluble, and which exudes on the brick and, coming in contact with the carbonic acid which is always in the air, becomes rapidly carbonated to bicarbonate of soda. It is obvious that in this case pure cement would greatly diminish the efflorescence if not entirely prevent it, for the reason that pure cement is only slightly, if at all, alkaline in its reaction.

The second kind of efflorescence consists mainly of sulphate of magnesia. This is of a grayer color, and is seldom or never found in large quantity such as the bicarbonate of soda efflorescence obtains. It is, in my opinion, generally, if not always, due to the presence of pyrites or some other sulphide in the clay before burning. The process of burning thereby produces sulphuric acid, which combines with the various other ingredients of the clay, forming probably sulphate of alumina, and, perhaps, some sulphate of iron. These bricks, when laid in cement which contains very considerable quantities of magnesia, will, of course, be more liable to efflorescence than when laid in lime mortar.

I am much interested in what Mr. Clark says of the use of linseed oil, and would gladly have him publish in your paper the theory on which this assistance from linseed oil is obtained, and, if possible, the experiences which have led to its adoption. I remain,

Yours very truly,

SAMUEL CABOT.

LARGE quantities of salt may be used with Portland cements in freezing weather without seriously injuring the mortar, and considerable amounts may also be used with natural cements. Portlands harden much faster than natural cements, and require less water for their manipulation; the former are very much to be preferred for use in freezing weather. — *Municipal Engineering.*

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

CHICAGO.— An event attractive to Chicago lovers of architecture was the annual exhibition by the Chicago Architectural Club, which was given in the Art Institute during the first ten days of this month.

The arrangement of the collection as a whole on the walls of the galleries gave a pleasing first impression, and the systematic grouping made one remember just where he wanted to go back on a second visit to study more thoroughly the photographs of the Boston Public Library, or some attractive feature of the Columbia College representation. The University of Pennsylvania School of Architecture contributed a long list of drawings. There were designs by members of the Sketch Club of New York, the Philadelphia T Square Club, and the Architectural Clubs of Detroit, Cleveland, and St. Louis. There were many notable designs showing the work of such architects as Wilson Eyre, Ernest Flagg, Mason & Rice, and J. A. Schwimfurth. The exhibition surpassed any previous one, and it was not necessary this year to fill up with elaborate displays of furniture and hardware. Home talent in this architectural exhibition was somewhat overshadowed by the good representation from abroad. One item of special local interest was the plan and a well-rendered water-color bird's-eye view of the treatment proposed by the Chicago Architectural Club for the new Lake Front Park. Filling in the lake front has actually begun, and Chicago now looks forward to what may be made, if properly handled, one of the finest parks in the world.

Let it be recorded that the contract to raze the old Post-Office and Government Building was let April 6, 1896, to a party who offered to tear down the pile and clear away the last of it within five months, and pay $47,300 for the privilege of doing it. Henry Ives Cobb, who was appointed architect of the new building, is getting his part of the work under way.

Just now brick and terra-cotta people are asking themselves if they are going to sit still while stone dealers (for it is said that they already are pulling the wires) tie up this important new building to their material for the exterior.

It is interesting in this connection to recall that a certain large office building in Chicago was to have an all-granite exterior, and, in obedience to the owner's wishes, drawings and calculations were made with that intention. But it was found, not only that the steel framework would have to be heavier and more expensive, and that the large excess of weight needed more foundation area than existed under the building, but that the stone could not possibly be obtained without serious delay. Terra-cotta was adopted, and one of the finest buildings in Chicago was put up, and made ready for tenants in eight months.

It would be a matter of regret if this new government building should keep up governmental traditions by failing to go up under the spirit of modern ideas. Light and air, space, beauty, and stability ought to have the same consideration in public or private hands. The difference between a wall 2 ft. thick and one 4 ft. thick is a large amount of floor space, worth to a tenant $2.00 per square foot in each story, — not to mention the cost of the wall.

Building news is a little more encouraging. The newsgatherer who haunts the architects says that many of them are busy, while other well-known architects find things a little slow.

One new office building is on the boards. D. H. Burnham & Co. are the designers. The structure will be 90 by 91½ ft. in plan, and will stand at the corner of State and Washington Streets, one of the finest locations in the city.

Dwight H. Perkins is designing a medical college building, to cost $40,000.

Holabird & Roche have alterations, a new front and so forth, under way for a Dearborn Street hotel. They have on hand also a wholesale building at the corner of Market and Congress.

The rest of the month's building news of importance (price being the criterion) is monotonous. Nelson Apartment Building, at Cottage Grove and Indiana Avenue, to cost $75,000.

Lehman apartment building, Clark and Fullerton Avenues, $110,000.

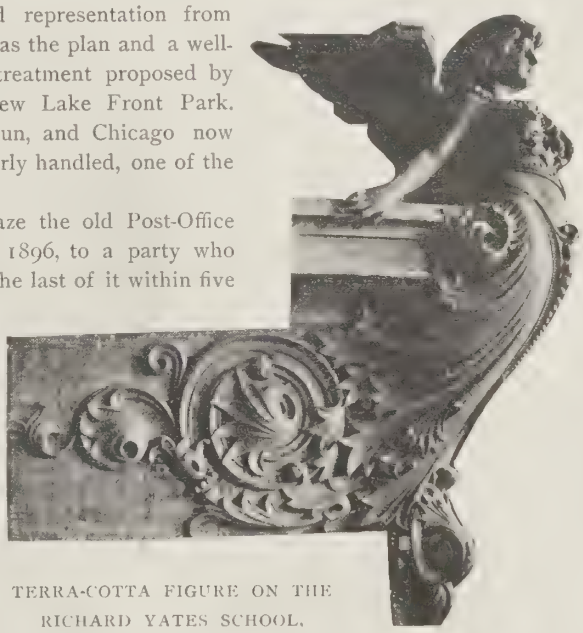
Two Follansbee apartment buildings near 23d and Wabash, to cost $300,000. I. C. Zarbell, architect.

Apartment building, 250 Madison Street, to cost $100,000. C. J. Furst, architect.

Apartment building on Dearborn Avenue, $100,000. G. S. Kingsley, architect.

The great majority of apartment buildings are four stories high, without passenger elevators.

Unlike some of the big apartment buildings which never get beyond paper, the $600,000 manufacturing plant designed by Treat & Foltz is to be a verity.



TERRA-COTTA FIGURE ON THE RICHARD YATES SCHOOL, CHICAGO.

A. FIEDLER, Architect.

Executed by the American Terra-Cotta and Ceramic Company.

ST. LOUIS. — This promises to be one of the quietest seasons we have had for some time, notwithstanding the fact that the permits issued shows more money is being invested in building than at any time during the history of St. Louis. The reason for this is that the three largest buildings ever built here have been started about the same time.

The Liggett & Myers tobacco factory, the largest plant of the kind, perhaps, in the world, is being done by Jonathan Clarks & Sons Company, of Chicago, and will cost, when completed, about one and one quarter million dollars. An immense army of workmen are employed, and it is being pushed in true Chicago style.

The same contractors have the Century Building, running from Olive to Locust Streets on Ninth Street, on the site of the old Pope's Theater. The building is to contain a theater, stores, and offices, and will cost something over a million dollars. It is of iron and steel construction, faced with marble. It is the first important building here, in which marble has been used on the exterior.

One block away from the Century Building is the Chemical Building, which already pierces the clouds, and will, within a couple of weeks, look down with disdain upon its fourteen-story neighbor, the Union Trust Building, which stands just across the alley. The building was designed by Henry Ives Cobb, and will be sixteen stories. The two first stories are of ornamental iron, and above of dark red brick and terra-cotta to match.

Some time ago there was an ordinance introduced into the city council to limit the height of buildings to 125 ft., which created quite a stir in architectural and realty circles, and provoked considerable opposition, but it seems to have gone the way of much other legislation in our city. After it got in the hands of the committee no more was heard of it.

A ray of hope has at last pushed itself through the cloud that has hovered so long around the new City Hall, and after much talk of scandal and corruption, and a farce of an investigation, an ordinance has been passed, which, although not officially, effectually deposes Architect Mann, and places the work in the hands of Mr. R. E. McMath, the president of the Board of Public Improvements, with a consulting architect, for which position Theo C. Link has been selected, and a corps of draughtsmen and inspectors has been engaged. Mr. McMath promises to push the work as rapidly as possible, and hopes to have the building finished within eighteen months.

HOTEL WALTON, PHILADELPHIA.
Angus S. Wade, Architect.

Work is progressing quite rapidly on the Auditorium Building, designed by Isaac Taylor, for the Republican National Convention. It is only a temporary building, being constructed on the south side of the City Hall lot, and is to be removed before winter.

Scarcely had the first shovel of dirt been thrown before there were whisperings of a general strike of the labor unions, owing to the employment by the contractor, R. P. McClure, of a sub-contractor for a small amount of the work, who does not work union men. Although the contractor promises the completion of the building on time, strike or no strike, any trouble of this kind would be particularly unfortunate. The building not being finished on time would mean much to St. Louis, and although much interest is always felt in the workingmen, any action of the labor unions which would cause delays would not meet with much sympathy from the public.

PHILADELPHIA.—If we are to judge the future by the present prospect, it would seem as if Philadelphia will have a year that will be a veritable record breaker; there have been an unusually large number of permits granted thus far, and there are amongst them some which call for very large buildings; there appears to be no end to the high building craze in this city, although it has so far not reached the extremes which it did in New York and Chicago. The highest thus far projected is to be located upon the site of the Girard House, and calls for sixteen stories; it will, however, not be built this season, but arrangements are being made to begin operations looking to the preparation of the usual preliminary work, in order that there will be no delay after the first of the next year, at which time the new parties will get possession. It is understood that the project is backed by New York capitalists, but to what use the building will be devoted has not been definitely ascertained.

Another project upon which estimates are now being made is a building for the Physicians and Dentists Association; it is to be for the use of physicians and dentists, and of the various uses pertaining thereto; the building, as at present planned, shows no advance above the usual methods and seemingly might be improved considerably, especially in the appearance of its exterior, which threatens to be about as near a copy of the old common cast-iron fronts as one could well make.

Messrs. Frank Miles Day & Bro. are engaged upon the preliminary work for the new building which the Baptist Publication Society will erect upon the site of the one recently destroyed by fire; the building will be entirely for the uses of the society and its kindred interests, and as at present contemplated will be ten stories high.

The Broad of City Trusts are having drawings made by Architect Windrim with a view of determining the possibilities of the site bounded by Twelfth, Eleventh, Girard, and Chestnut Streets; it is possible that there will be erected upon this site one immense building 400 by 220 ft., and not less than twelve stories in height. The first floor will contain from 24 to 30 storerooms, a large hall, and the necessary foyer and arcades. To what use the upper floors will be devoted has not been definitely decided, but the board have applications from several institutions for halls, apartments, and libraries, which will be considered; the Franklin Institute have applied for part of the building, as have also the trustees of the Public Library.

This site is one of the finest in the city, and it would be almost impossible to find one larger and better adapted to the requirements of the present day.

Architects will anxiously await the completion of the sketches, in the hope that they will add much to the advanced trend of building in this city.

But the worst is yet to come. There is a project on foot for rebuilding the Municipal Hospital in the suburbs of the city, and it would seem to be an unusually good opportunity to outstrip some of the similar efforts which are being made in this direction in other cities; but, alas! there comes forth some one in authority (I am pleased to say not an architect) who submits and presses the adoption of a scheme so very absurd that we are surprised that any of our daily papers should waste the space necessary to describe and show

CARNEGIE OFFICE BUILDING, PITTSBURG, PA.
Longfellow, Alden & Harlow, Architects.

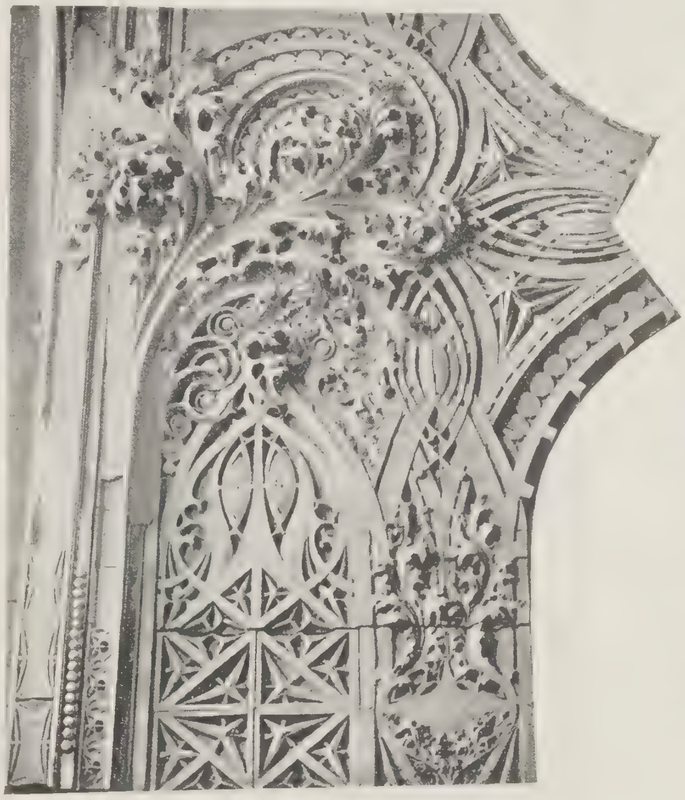
a cut of it. It is proposed by these individuals to put up a building with an outer covering of galvanized iron, and an inner lining of the same material, the space between the two surfaces being filled with mineral wool or some other similar material. The advantages of this method of construction are not given in the article published, but it is said to be "just the proper thing" and will meet with "universal approval"; the most singular feature of the proposition, as far as we have been able to investigate, is, that it is not, as might be expected, the suggestion of either a dealer in mineral wool or a firm of galvanized iron workers.

HOTEL WALTON.

One of the important events of recent occurrence in this city was the opening of Hotel Walton, Angus S. Wade, architect. It occupies the site at Broad and Locust Streets, and its commanding presence is emphasized by three oriel towers, which, with a sloping roof, is covered with a handsome red tile furnished by the Celadon Terra-Cotta Company, Charles T. Harris, Lessee, Alfred, N. Y.

Their "Conosera" tile, which is especially adapted to the fitting of cones and all warped surfaces, was used. The design is an adaptation of the Moorish style of architecture. The first two stories are of richly carved brownstone and the upper stories of dark red brick.

The "Walton" is owned by Robert Goelet, of New York City, and is named in honor of his son.



TERRA-COTTA DETAIL USED IN GUARANTY BUILDING, BUFFALO.
ADLER & SULLIVAN, ARCHITECTS.
Executed by the Northwestern Terra-Cotta Company.

PITTSBURG.—Since Pittsburg has lost the National Republican Convention on account of not sufficient hotel accommodations, she has come to her senses and quite a number of hotel projects are reported. One of these, for L. C. Phipps, is to be an eight-story building of brick and terra-cotta on Penn Avenue, from plans prepared by Architects Longfellow, Alden & Harlow.

Several warehouses are contemplated by the Denny estate on Grant Street near Seventh Avenue, to be six stories in height, slow burning construction, from plans by Architect T. H. Scott.

It is reported that Arbuckle Bros. & Co. will erect a six-story storehouse building on 31st Street, to be of steel frame construction filled in with brick and stone.

Architect T. D. Evans has prepared plans for a row of flats to be erected on Washington and Franklin Streets by a syndicate who will invest about $160,000 in the enterprise; to be eight stories high.

Architect Brady of the Department of Public Safety has prepared plans for a new engine house for the Fourteenth Ward.

Architects Rutan & Russell have prepared plans for an armory building for the National Guards, to be erected at a cost of about $250,000.

The St. Francis Hospital, 44th Street, owing to its being overcrowded, has decided to build an addition of brick and stone, to cost $35,000, from plans prepared by Architect S. F. Heckert.

It is reported that the West Penn Hospital will erect a large building at a cost of about $1,000,000.

There is also talk of building a new United Protestant memorial hospital for children, in Allegheny, to cost between $40,000 and $60,000.

Among the church projects may be mentioned a stone building for the Protestant Episcopal Congregation of the Ascension at Ellsworth Avenue, to cost about $75,000.

The St. Paul's United Evangelical Protestant German congregation will erect a new church building at First and East Streets, Allegheny.

The Third Ward Allegheny School Board contemplates the erection of a new school building, to cost about $340,000, to be three stories high.

The Washington Street Hebrew Synagogue will erect a new school building this spring, to cost $25,000.

ALBANY, TROY, AND VICINITY.—The casual visitor to Albany, Troy, and vicinity sees so little variety in the style of the various buildings that the impression is received that there is nothing, with possibly few exceptions, worth seeing in the way of architecture. But were that same person to make a systematic search, he would find a great many examples to examine and study, especially of that style which is so much in vogue at the present time,—viz, old Dutch colonial—and, would space permit, a list could be given which would be well worth one's time to look up and take as inspirations. Until within a few years, however, architects were so hampered by the wishes of their clients, who wanted a building like some one else had built, that it was almost an impossibility to design a building that would have any claims to artistic merit; but the time seems to have arrived when the people of this locality have wakened to the fact that it is possible to have their wishes complied with without any sacrifice to design, and we have now the commencement of a new era in building.

Among the recent buildings erected may be mentioned the Masonic Temple in Albany, by Fuller & Wheeler; the parish house of St. Peter's Episcopal Church, by R. H. Gibson, and many others.

In Troy, the Seminary Buildings, County Court House, Humane Society Building, by M. F. Cummings & Son; the Hart Memorial Building, by Barney & Chapman of New York, of which more may be said in a subsequent number; the M. E. Church Building in West Troy, by E. A. May; the City Hall, Cohoes, by J. C. Holland & Co., Topeka, Kan., and many other examples which space does not allow of a detailed explanation.

As spring comes in, the prospect for a busy season brightens daily and everything points to a very prosperous year in building.

Albany has in expectation two large bank buildings, with several other schemes of a lesser importance.

Troy will undoubtedly have a new Y. M. C. A. building, as several sites are held in refusal by the committee.

Taken altogether after a period of two years of inactivity, there will be a movement little less than a boom for Albany, Troy, and vicinity.

This statement is bourne out by a very substantial measure in sales and transfers of real estate.

ROCHESTER. — Building operations have improved considerably here of late. There is more work being done, and more about to be started, than there has been for some time.

The Security Trust Company will erect a new building, corner of East Main and Water Streets, for which Du Fais & Canfield, New York City, are the architects.

Boston, New York, and Baltimore architects have been asked to submit designs for a new church for the Saint Paul's congregation. It is understood that the structure is to be a costly one.

Architect J. Foster Warner has prepared plans for a five-story building to be built on the Sibley triangle for Hiram W. Sibley.

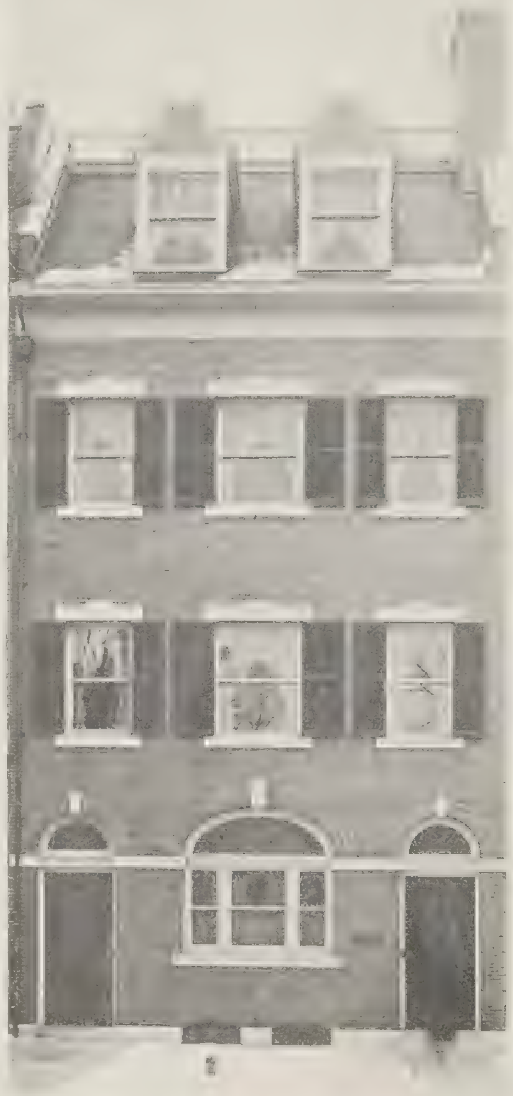
It will be of brick and terra-cotta, the latter supplied by the Perth Amboy Company.

Same architect has prepared plans for a three-story brick building for the Y. W. C. A.

Architects Walker & Briggs are preparing plans for a four-story block for Schaefer Brothers, on Central Avenue, 65 ft. front, of pressed brick.

Architects Nolan, Nolan & Stern have prepared plans for a store and apartment building for Simon Goldsmith. Pressed brick front.

Architects O. K. Foote and Claude F. Bragdon have taken offices in the new Cutler Building.



A COLONIAL RESIDENCE, BUFFALO, N. Y.
Broughton & Johnson, Architects

COLUMBUS, O. — The indications are that this will be a very different year, in the building trades, from last year. All of the architects have work under way — some of them have quite large work. Mr. Linthwaite has plans completed for a business block for the Central Ohio Paper Company, to be 94 ft. front by 187 ft. deep, four stories high. It will be built of brick and terra-cotta, the front brick being gray. He has also completed plans for two fine residences, one for Mr. J. A. McCune, and one for Mr. M. J. Bergen. The former house will be built of Roman gray brick, and the latter of standard size gray brick. The two houses will cost $50,000 and $30,000, respectively.

Mr. Dauben has completed plans for a residence for Mr. L. Hoster, to cost $30,000, to be built of stone.

Messrs. Kremer & Hart report plans completed for the remodeling of the county children's home, to cost about $12,000.

Messrs. Mills & Goddard have plans out for a block of eight residences, for Judge S. N. Owen, to be built of buff brick and terra-cotta. The same firm have plans completed for residences for W. A. Schart and Dr. E. B. Jones.

DETROIT.— There has been a large amount of scandal in connection with the adoption of plans for the new court house for Wayne County. Several architects report having been approached by supervisors or their representatives; and one of the board — John Chris. Jacob — has been arrested on the sworn complaint of E. E. Myers and George W. Myers, who charge him with soliciting a bribe to influence the vote of the supervisors' committee. There are eight members of the committee, and the Myerses allege that Jacob required $8,000 previous to the vote to be divided among the eight; $4,000 more as soon as the architects' plans should be adopted, and $8,000 later; making $20,000 in all, or one half the architects' commission of five per cent. on an estimated total cost of $800,000. The examination of Jacob is set for April 10, and is looked forward to with great interest.

The hotel and Turkish bath house designed by Architects A. C. Varney & Co. for Gabriel Chiera is now an assured fact. The building will cost $50,000, and with all the bath equipment completed, $85,000. Messrs. Varney & Co. will also prepare the plans for a store and office building for George W. and Octavia Bates, to be built on the southwest corner of Woodward Avenue and Clifford Street. Same architects are preparing plans for a gorgeous ginger ale depot for ex-alderman James Vernor. The front of the building, which is on Woodward Avenue near Woodbridge Street, will be finished in white and gold, and the interior handsomely decorated and divided by rich art glass partitions.

Architects Mason & Rice have prepared plans for a warehouse for the Star Dockage and Storage Company. It will be of steel frame construction, 100 ft. square and three stories high. The exterior will be of pressed brick.

Thomas A. Hyland has prepared plans for an armory for the Detroit National Guard, to be built on Howard near First Street. It will be four stories high, of pressed brick and stone trimmings, and will cost $30,000.

Architects Spier & Rohns have designed a church edifice for St. Thomas Roman Catholic Society of Ann Arbor, Mich. It is of Gothic architecture, and will be constructed of field stone with cut brownstone trimmings and tile roof. Cost, $50,000.

Architects E. A. Walshe & Son have had their plans adopted for a three-story brick schoolhouse, 120 by 84 ft., to be built in Debray, a suburb of Detroit. It will be of buff pressed brick; cost, $20,000.

The Detroit College of Medicine will build a large annex to be used as a veterinary hospital, for which Architects Nettleton, Kahn & Trowbridge are preparing the plans. The exterior will be of pressed brick.

Architect Edward C. Van Leyen has designed several fine residences for J. R. & R. J. McLaughlin, to be built on King and Alger Avenues. They will be of pressed brick trimmed with ornamental, molded brick.

A six-story addition of brick is to be built on the Griswold House Hotel, for which plans are being prepared. The estimated cost is $50,000.

Architects John Scott & Co. have prepared plans for a fine residence for F. S. Case, on Virginia Avenue.

Fred T. Houk is preparing plans for a terrace for ten residences for Barr & Son, to be built at the corner of Theodore and Brush Streets. They will be of buff pressed brick, trimmed with Ohio buff sandstone.

Architect F. J. Grenier has plans for a three-story double residence to be built on Canfield Avenue, C. D. Lowrie owner; also a three-story residence for J. T. Hortung, Ferry Avenue.

MINNEAPOLIS. — There is considerable activity in the various architects' offices, and we feel confident of a fairly good year.

Work has commenced on a number of large structures, among them the $75,000 King warehouse.

It is proposed to resume work on the new dam, began last fall, below the present falls, and push it to completion. This means work for hundreds of men, and an expenditure of several millions of money. It is headed by our most progressive and energetic flour manufacturer, Charles A. Pillsbury, and represents considerable English capital.

There is another capitol competition "on" now, Montana being the State this time that asks architects to donate time and money to permit her commission to make a proper selection of plans and "planner" for her most important building. Judging from the circular of instructions issued to architects, it will probably be on a par with preceding competitions.

It is expected that the contracts for the foundations of our capitol building will be let so as to begin work by May 1.

The following buildings are among the list reported since last month. Architect H. W. Jones has planned a double store building for Stremel Bros., on Washington Avenue, North, 50 by 140 ft., two story and basement, pressed brick fronts, cost $10,000.

Same architect, plans for store building 50 by 100 ft., two story and basement, on Plymouth Avenue and Second Street, for Peter Faber, to have pressed brick front, cost $8,000.

Same architect, a residence at Linden Hills for C. W. Van Tuyl, 40 by 54 ft., two story and basement, buff pressed brick, to cost $8,000.

Architect S. J. Bowler, store building, 50 by 100 ft., at corner Washington Avenue and Cedar Street, three story and basement, pressed brick and stone, to cost $12,000.

T. B. Walker is building stores, 90 by 100 ft., three story and basement, red sand mold brick and brownstone, to cost $80,000, opposite Central Market.

Architects Orff & Jovalemon have planned a store building at Eau Claire, Wis., for H. C. Putnam, 82 by 105 ft., red pressed brick, to cost $25,000.

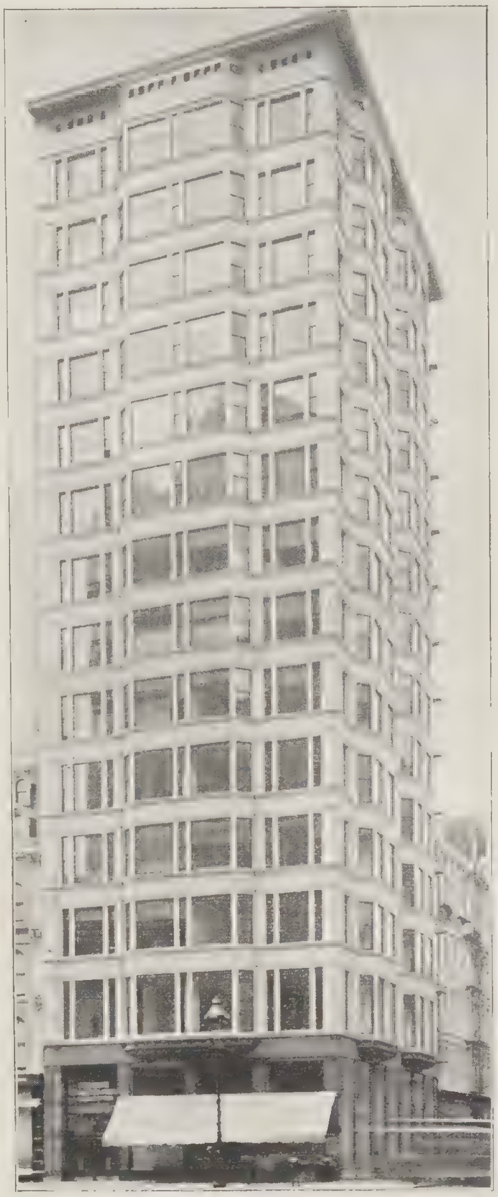
Same architects, a building for Citizens' National Bank, at Wahpeton, N. D., 25 by 80 ft., two story and basement, pressed brick and Ortonville granite, marble entrance, to cost $10,000.

Same architects, a church at St. Peter, Minn., for M. E. Society, 53 by 78 ft., to cost $10,000.

Same architects, an eight-room school building at Lamberton, Minn., 72 by 75 ft., two story and basement, brick and stone, to cost $15,000.

Architect C. S. Sedgwick has planned a residence for M. W. Savage, on Portland Avenue and Twenty-sixth Street, 47 by 61 ft., to cost $10,000.

The only large undertaking reported from St. Paul this month, aside from the new capitol building, is the new Insane Hospital for St. Croix County, at New Richmond, Wis., by Buechner & Jacobsen, architects. Main building, 116 by 134 ft., with front wing, 44 by 57 ft., three story and basement, pressed brick with stone trimmings for fronts, to cost $50,000.



RELIANCE BUILDING, CHICAGO.
D. H. Burnham & Co., Architects.

THE ESSENTIALS OF TERRA-COTTA CLAY.

THOSE who are desirous of making good terra-cotta should determine first whether their clay is suitable for the manufacture of such goods. This of course can be done empyrically or by trial, taking care, if the clay be gritty, to have it well washed and mellowed before being used for molding. A better plan, or shall we say one which gives results from a different standpoint, is to determine the composition of the clay. If such results be combined with those obtained by trial, we are likely to arrive at a satisfactory conclusion that is based on theory and practise.

The famous terra-cotta deposits at Watcombe, near Torquay, may well be taken as a standard of what fine clay for modeling and molding ought to be. This clay is superior in physical as well as in chemical properties. Its composition was ascertained by the late Mr. J. W. Ward to be as follows: —

Silica	57.83
Alumina	20.55
Peroxide of iron	7.75
Lime	1.68
Magnesia	0.97
Peroxide of manganese	trace
Carbonic acid	0.90
Potash	3.87
Soda	0.56
Phosphoric acid	trace
Absorbed water	2.13
Combined water	4.39
	100.63

The remarkable features are the nicely balanced percentages of the silica and the alumina, the low content of carbonates, the fairly high content of alkalies, [and a fair richness in iron. It is doubtful whether the traces of manganese and phosphoric acid are possessed of any material significance. — *British Clay-worker.*

WATCH THIS COLUMN FOR POINTERS.

THE POWHATAN CLAY MANUFACTURING COMPANY, Richmond, Va., are putting a very handsome gray and gray speckled brick on the market.

THE NATIONAL BRICK COMPANY, of Bradford, Penn., report large sales of their brick through O. D. Person, of New York City, and Charles E. Willard, Boston, agents. They report that inquiries and orders for future delivery point to a prosperous trade. The size of their red press brick, which has found universal favor among architects, is 8¼ by 2½ by 4⅛.

THE ANTHONY ITTNER BRICK WORKS, of St. Louis, report a good trade during the past winter, which has not been severe enough in that locality to seriously interrupt building operations. This company is prepared to make special designs in brick, if given three or four weeks' notice. The Ittner factory is one of the oldest and best known in the country.

TIFFANY PRESSED BRICK COMPANY, Chicago, are supplying pressed brick for the new addition to Ashland Block, Chicago, and enameled brick for the A. H. Trude Building.

THE PHILADELPHIA & BOSTON FACE BRICK COMPANY, Boston, have recently shipped brick for two mantels, to Kioto, Japan; and for one mantel to the Sandwich Islands. Freight on these mantels is three or four times the value of the goods.

THE POWHATAN CLAY MANUFACTURING COMPANY, of Richmond, Va., are shipping their cream-white bricks to Washington, on the following jobs: four residences on Washington Heights, John H. Lane, contractor; five residences, same locality, William H. Kimmel, contractor; five residences, cor. 17th and R Streets, David M. Lea, owner.

MESSRS. HAM & CARTER, 560 Albany Street, Boston, are agents for the Dyckerhoff Portland Cement.

DYCKERHOFF PORTLAND CEMENT is now being used in the Boston Subway; also in the Siegel-Cooper & Co.'s stores, Sixth Avenue, New York City.

NEW YORK & ROSENDALE CEMENT COMPANY have recently closed a contract with the city of Providence through their agent, Mr. James C. Goff, to supply the cement that will be required by the Sewer Department during the year. "Brooklyn Bridge" brand, Rosendale Hydraulic Cement, will be used.

THE NEW YORK & ROSENDALE CEMENT COMPANY have had their cement specified on the following work: new Astor Hotel; Waldorf Hotel extension; Brooklyn Institute of Arts and Sciences; Columbia College, new buildings; Bowling Green Office Building.

THE POWHATAN CLAY MANUFACTURING COMPANY, of Richmond, Va., have opened a branch office in the Mohawk Building, 160 Fifth Avenue, New York City. F. H. S. Morrison, their sales manager, will have charge of this office.

IN the residence now being built in New York City, for Mrs. Mace, better known as Maggie Mitchell, cream-white bricks will be used, having a beveled edge. These bricks are being furnished by the Powhatan Clay Manufacturing Company. Same concern are furnishing their cream-white bricks for the new office building in Philadelphia, of the Mutual Life Insurance Company, of New York, P. W. Roos, architect.

THE PITTSBURGH TERRA-COTTA LUMBER COMPANY, Pittsburgh, have just closed a contract for a large amount of clay-working machinery for their new works to be located near Port Murray, N. J. At this factory they will manufacture ornamental building blocks, having secured the sole rights for the States of Pennsylvania and New Jersey, under the Durent patents.

TRADE literature of recent issue includes a pamphlet, "Hints on House Painting," and a series of cards showing five new shades of mortar colors, issued by William Connors, of Troy, N. Y., which will be sent on application. Mr. Connors reports that his plant is taxed to its fullest capacity, filling orders.

THE EMPIRE FIRE-PROOFING COMPANY, Pittsburgh, are supplying the fire-proofing for the new Siegel-Cooper Departmental Store, New York City. This is without doubt one of the largest, if not the largest, fire-proof building in the world. It has nearly 700,000 sq. ft. of floor space. This same company has recently closed contracts in St. Louis, Chicago, Detroit, Toledo, Buffalo, Philadelphia, and Washington.

THE COLUMBIAN FIRE-PROOFING COMPANY, of Pittsburgh, are furnishing the fire-proofing for the Massachusetts Fire-proof Storage and Warehouse Company, Boston, Mass., Andrews, Jaques & Rantoul, architects.

PERTH AMBOY TERRA-COTTA COMPANY are furnishing terra-cotta on the following contracts: Addition to the New York Life Insurance Company's Building, New York City, McKim, Mead & White, architects; building for the Metropolitan Telephone and Telegraph Company, Dey Street, New York City, Cyrus L. W. Eidlitz, architect; Edison Building, Atlantic Avenue, Boston, Winslow & Wetherell, architects; Church of the Sacred Heart, Lowell, Mass., P. W. Ford, architect.

CONKLING, ARMSTRONG TERRA-COTTA COMPANY, Philadelphia, Penn., are furnishing white terra-cotta for the Bowling Green Office Building, New York City, W. & G. Audsley, architects; gray terra-cotta for the Presbyterian Building, Philadelphia, Joseph M. Huston, architect; Pompeian terra-cotta for the St. Christopher's House, 88th Street, New York, Barney & Chapman, architects; Medico-Chirurgical Hospital, Philadelphia, Frank Miles Day & Brother, architects.

THE PIONEER FIRE-PROOF CONSTRUCTION COMPANY, of Chicago, are furnishing fire-proofing on the following contracts: Southern Express Company's office building, Memphis, Tenn., Weathers & Shaw, architects; the Uhline Building, Milwaukee, Charles Kirchoff, Jr., architect; the Trude Office Building, Chicago, Jenney & Mundie, architects; the Isolation Hospital, Chicago, De Wade, city architect; the Excelsior Brewery, Chicago, Lewis Lehl, architect; the Phipps Building, Pittsburgh, Longfellow, Alden & Harlow, architects; Wise County Court House, Decatur, Texas, J. Riley Gordon, architect.

THE FOLSOM SNOW GUARD COMPANY, Boston, have issued an illustrated pamphlet showing a dozen or more roofs that have been fitted with their New Model Snow Guards. They have recently furnished these guards on the following contracts: Sloan Maternity Hospital, and 88th Street Schoolhouse, New York City; City Hall in Cohoes, N. Y.; Fitchburg Railroad depot, Gardner, Mass.; fire station, and new high and grammar schoolhouses, Malden, Mass.

THE GRUEBY FAIENCE COMPANY, of Boston, have contracted for faience work in the New York, New Haven, Hartford & Railroad's new stations now being erected at Brockton and Campello, Mass.; Bradford L. Gilbert, architect. The color in this work is a delicate flush of pink — almost white.

They have also recently received an order for three special mantels for the Children's Hospital, Detroit, Mich.; Andrews, Jaques & Rantoul, architects. These are to be done in colors, the shades being cream yellow, blue, and green.

MESSRS. J. & R. LAMB, of New York, have recently completed a number of examples of mosaic work, in which the French enamel is being used very successfully. As this enamel is a ceramic mosaic, it should be of special interest to all of our readers. This particular medium is very desirable from two points: First, its great variety of color, and second, its absolute durability; each piece, being vitrified, is of the same density and hardness.

In the important mausoleum just completed at Woodlawn, the "Dunlop," one of the most elaborate of the new mausoleums erected there, this was used for the floor, a very important design of heraldic character, the coat-of-arms of the family being placed in the center of a richly bordered design. The colors, which were very rich, were added to by pure gold and silver "frit."

J. W. PENFIELD & SON, Willoughby, Ohio, have recently completed arrangements whereby they secure exclusive control of the Haigh continuous system of brick burning, and it will hereafter be known as The Universal Continuous Kiln. A distinguishing feature of this kiln consists in the adoption of side-firing, enabling them to secure the advantages of side-firing isolated kilns, with the economy in fuel secured by ordinary continuous systems of brick burning. This kiln is adapted for burning not only common brick, but also pressed brick, paving brick, fire brick, hollow ware, etc.

The Goetz Box-Anchor Company, of New Albany, Ind., have made an addition to their factory, the capacity of which will be at the rate of one hanger per minute. The hangers that they are now putting out are burnished and varnished, which adds much to their appearance. Recent shipments to Salt Lake City, Atlanta, Ga., and Worcester, Mass., would seem to indicate that they find a market in the whole United States.

PROPOSITION FOR COMPETITION.

HENRY A. GOETZ, of New Albany, Ind., inventor of the Box Anchor Post-Cap and Joist Hanger bearing his name, makes the following proposition: To donate to any architectural club the sum of two hundred dollars if he is not able to demonstrate that his methods of building, by the use of his inventions, are the best for certain kinds of work, especially warehouses, — the terms of the competition to be about as follows: —

1. The club is to make a plan of a warehouse, four stories, upon the slow-burning principle, in which durability, the arrangement of material, strength, and fire safety shall be the features, rather than ornamental design.
2. Goetz shall make a plan of the same kind, using his patented improvements as he intends they should be used.
3. All plans shall then be referred to a committee, composed of an architect, an insurance rate expert, and some person who owns or has built several large warehouses, and they will award the money to the best plan.

If Goetz gets the premium he must prove: —

1. That his method of building will get the lower rate of insurance.
2. That his method is more durable and stronger than any competing plan.
3. That his plan of building will suffer less loss at a partial destruction by fire or wind than any competing plan.
4. That his improvements, used as a whole, will actually cost less money to build, or not more than competing plan next his in merit.

The entire membership of club being allowed to incorporate their ideas into their club plan, but not allowed to use any of the ideas advanced by Goetz in his printed literature.

WASHINGTON MONUMENT.

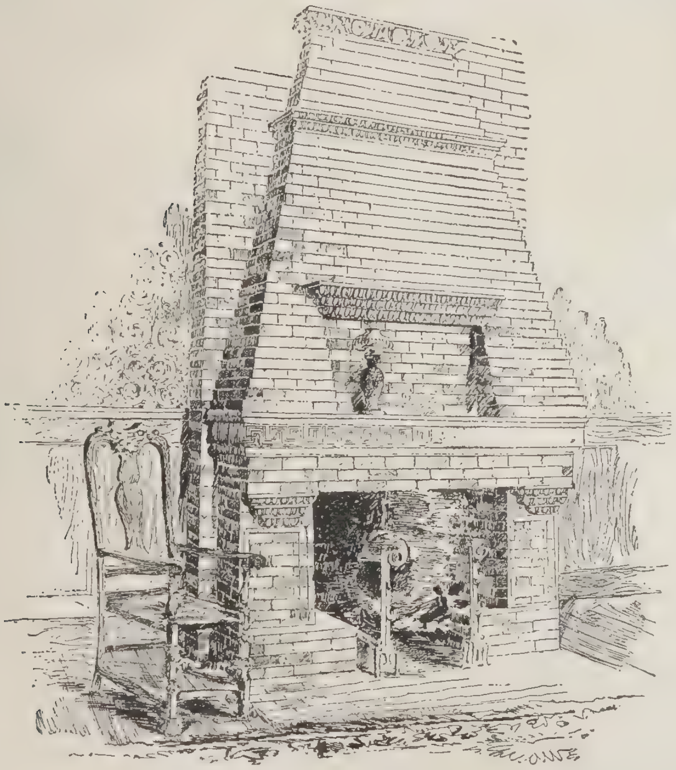
As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,
College Avenue, St. Louis, Mo.

We construct and equp brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do. **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, College Ave., St. Louis, Mo.



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Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

JUST THE THING

FIREPLACE MANTELS MADE OF MOULDED BRICK

In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

PHILA. & BOSTON FACE BRICK CO.,
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Is superior to any other Portland Cement made. It is very finely ground, always uniform and reliable, and of such extraordinary strength, that it will permit the addition of 25 per cent more sand, etc., than other well-known Portland Cements, and produce the most durable work. It is unalterable in volume and not liable to crack.

8,000 barrels have been used in the foundations of the Bartholdi Statue of Liberty, and it has also been used in the construction of the Washington Monument at Washington.

Pamphlet with directions for its employment, testimonials and tests, sent on application.

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Sole Agent United States.

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"GERMANIA" (German Portland Cement).

Positively the best sidewalk cement made.

This statement is based upon reports from consumers throughout the country.

Germania was selected in preference to all others for use in laying the walks in front of the White House, at Washington, on account of its almost perfect color and great durability.

FOR CONCRETE FOUNDATIONS IT HAS NO SUPERIOR.

Pamphlets giving directions regarding mixture of sand for all kinds of work sent on application.

"GLOBE" (Belgian Portland Cement).

Tested by N. O. Olson, Engineer of Fairbank's Testing Dept., with the following results: Average tensile strength of five briquettes Neat Cement, seven days, **462 pounds per square inch.** Average tensile strength of five briquettes, one part Cement, two parts Sand, **172 pounds per square inch.**

The Globe Portland Cement has been furnished to the following contracts:—

Broadway Cable Road, New York City	40,000 bbls.
Foundation Terminal Warehouse, New York City	15,000 bbls.
Foundation Power House, Brooklyn City R. R.	15,000 bbls.
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ALPHA PORTLAND CEMENT COMPANY
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PORTLAND
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JAMES A. DAVIS & CO.
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"With a true sense of economy we would buy nothing in Europe but of necessity. The gold reserves of our government and individuals would then increase without even the intervention of tariffs."

Alpha Portland Cement

is the most economical. It is the finest ground cement on the market. For that reason it will take more sand and broken stone than any other cement in existence. To-day our best contractors and engineers consider it superior to any imported cement on the market. We guarantee every barrel of the "Alpha" to be uniform in quality, and to pass any requirement yet demanded of a Portland Cement.

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ATLAS PORTLAND CEMENT.

WARRANTED EQUAL TO ANY AND SUPERIOR TO MOST OF THE FOREIGN BRANDS.

OFFICIAL TESTS, Nos. 3567 and 3568, made by the DEPARTMENT OF DOCKS, New York, March 31, 1894, being part of contract No. 464 for 8,000 **barrels.**

TENSILE STRENGTH, 7 days, neat cement	622 lbs.
" " 7 days, 2 parts sand to 1 of cement	332 lbs.
Parts steamed and boiled	Satisfactory.

All our product is of the first quality, and is the only American Portland Cement that meets the requirements of the U. S. Government and the New York Department of Docks. We make no second grade or so-called improved cement.

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PORTLAND CEMENT
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MURSTON WORKS
LONDON

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ENGLISH PORTLAND CEMENT celebrated for Reliability, Chemical Purity, Great Strength, High Sand Carrying Capacity and General Uniformity. Quantity imported yearly far greater than any other brand.

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CIMENT PORTLAND
DE LA
SOCIETE J. & A.
PAVIN DE LAFARGE
A
VIVIERS (Ardeche)
N° K°
FRANCE

"Lafarge"

French Portland Cement, the only material to use for setting, pointing, and backing LIMESTONE and GRANITE.

Will not stain and makes the strongest binder.

James Brand, Importer, 81, 83 Fulton St., NEW YORK.
34 Clark St., CHICAGO.

ALSEN'S PORTLAND CEMENT.

The strongest, finest ground, and most uniform Cement in the world. Permits the admixture of more sand than any other, and is the best for mortar or stuccoing.

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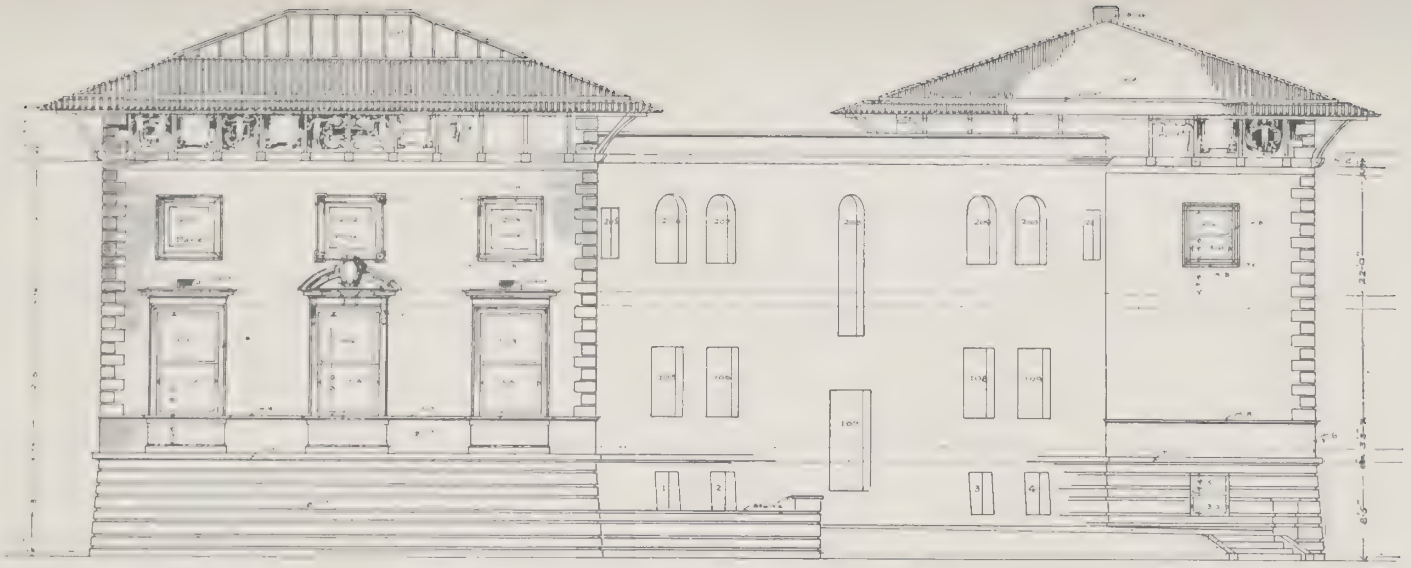

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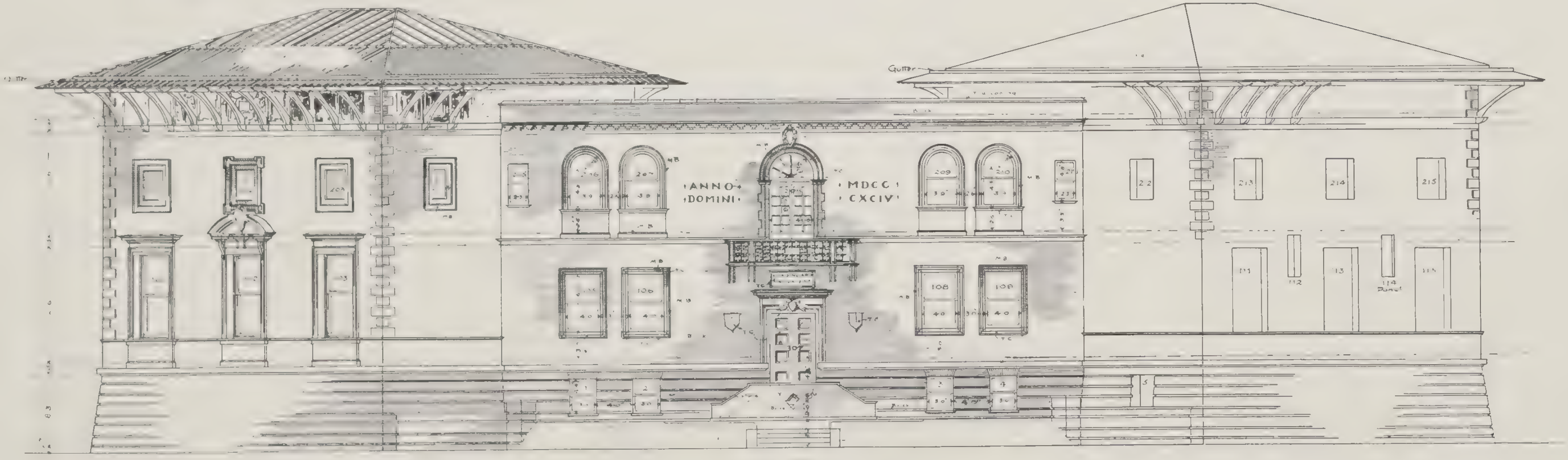
South-west Elevation

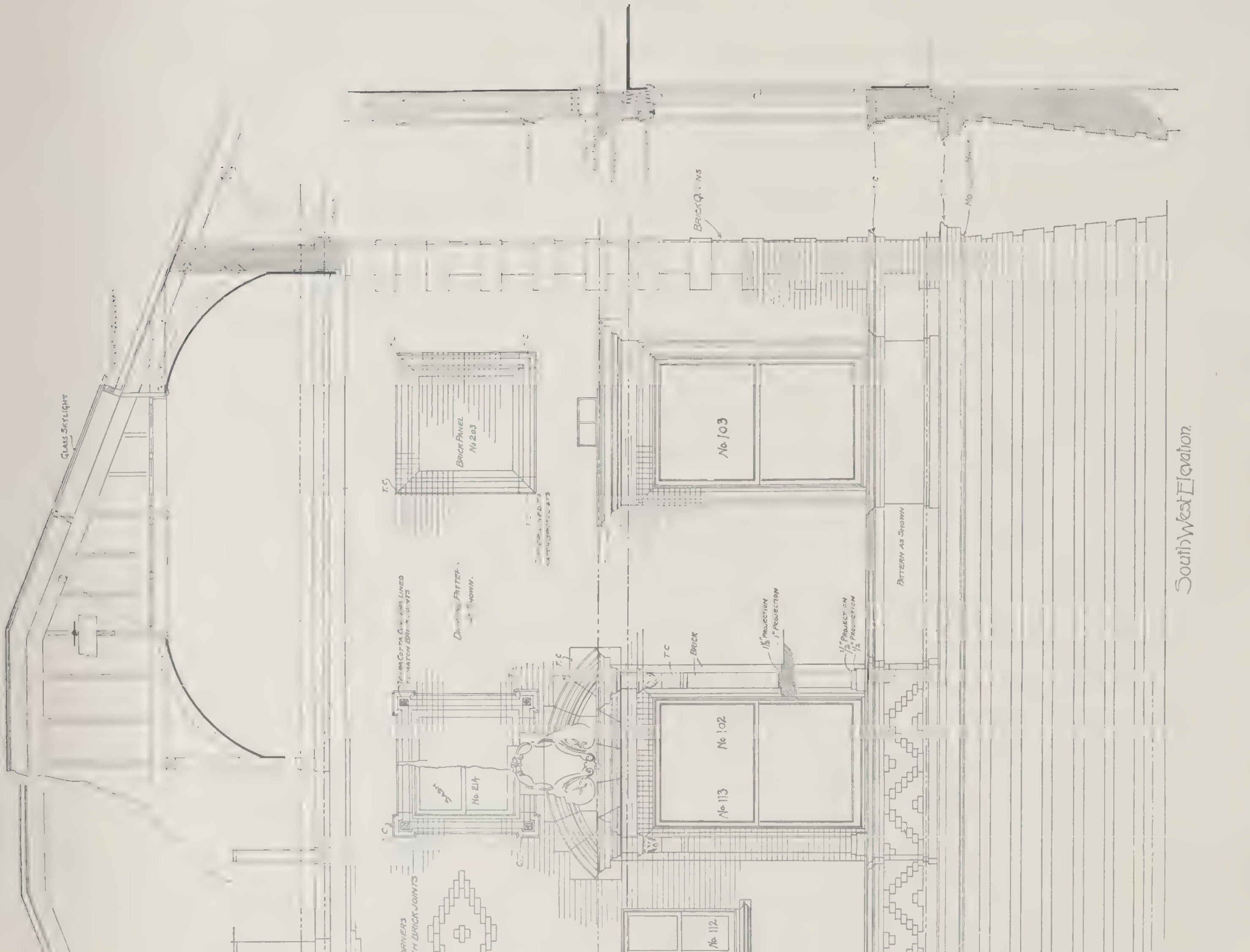


South Elevation

SCALE OF FEET

ART BUILDING FOR H. SOPHIE NEWCOMB MEMORIAL COLLEGE, NEW ORLEANS, LA.

WILSON EYRE, JR., ARCHITECT.



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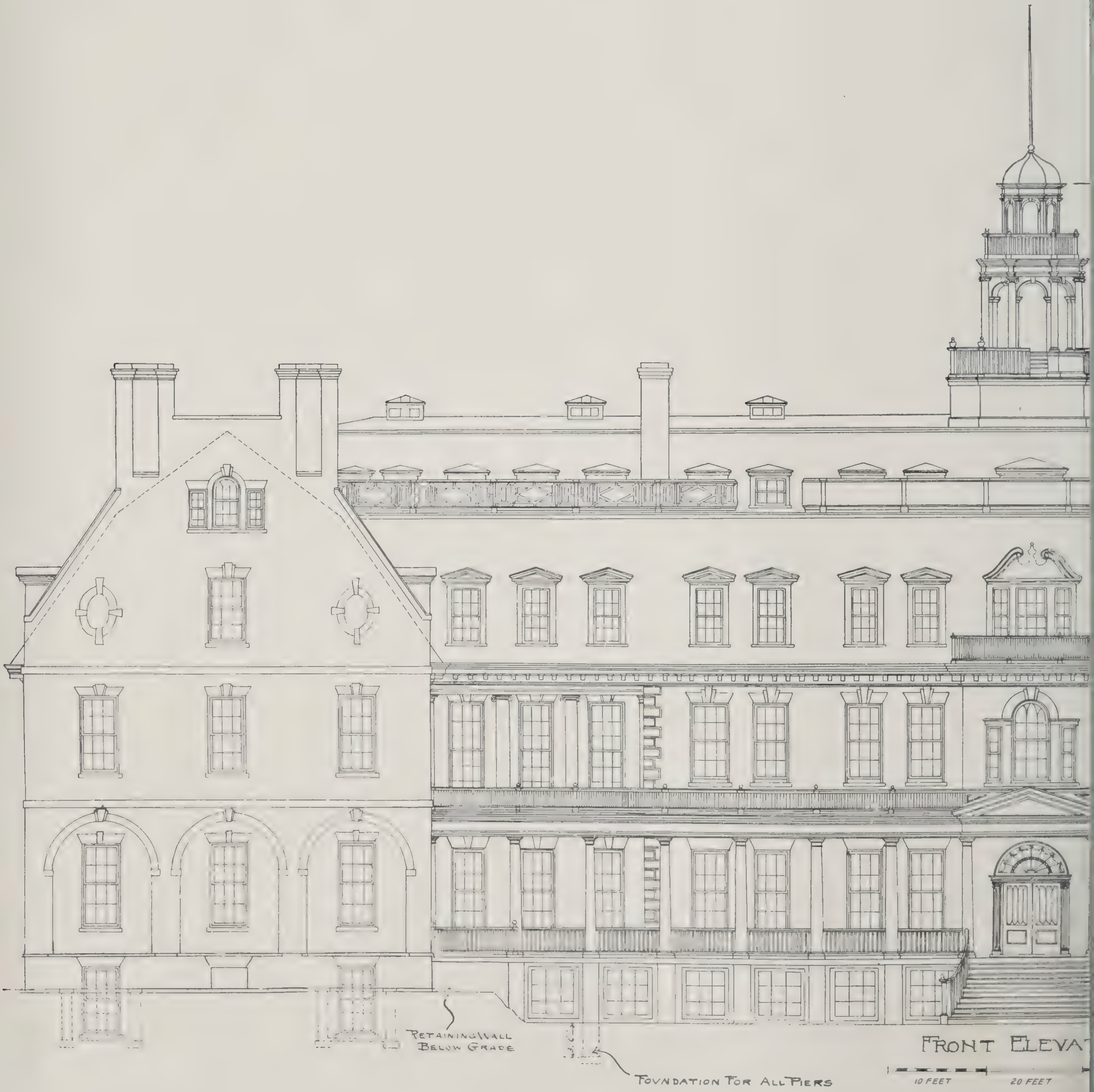
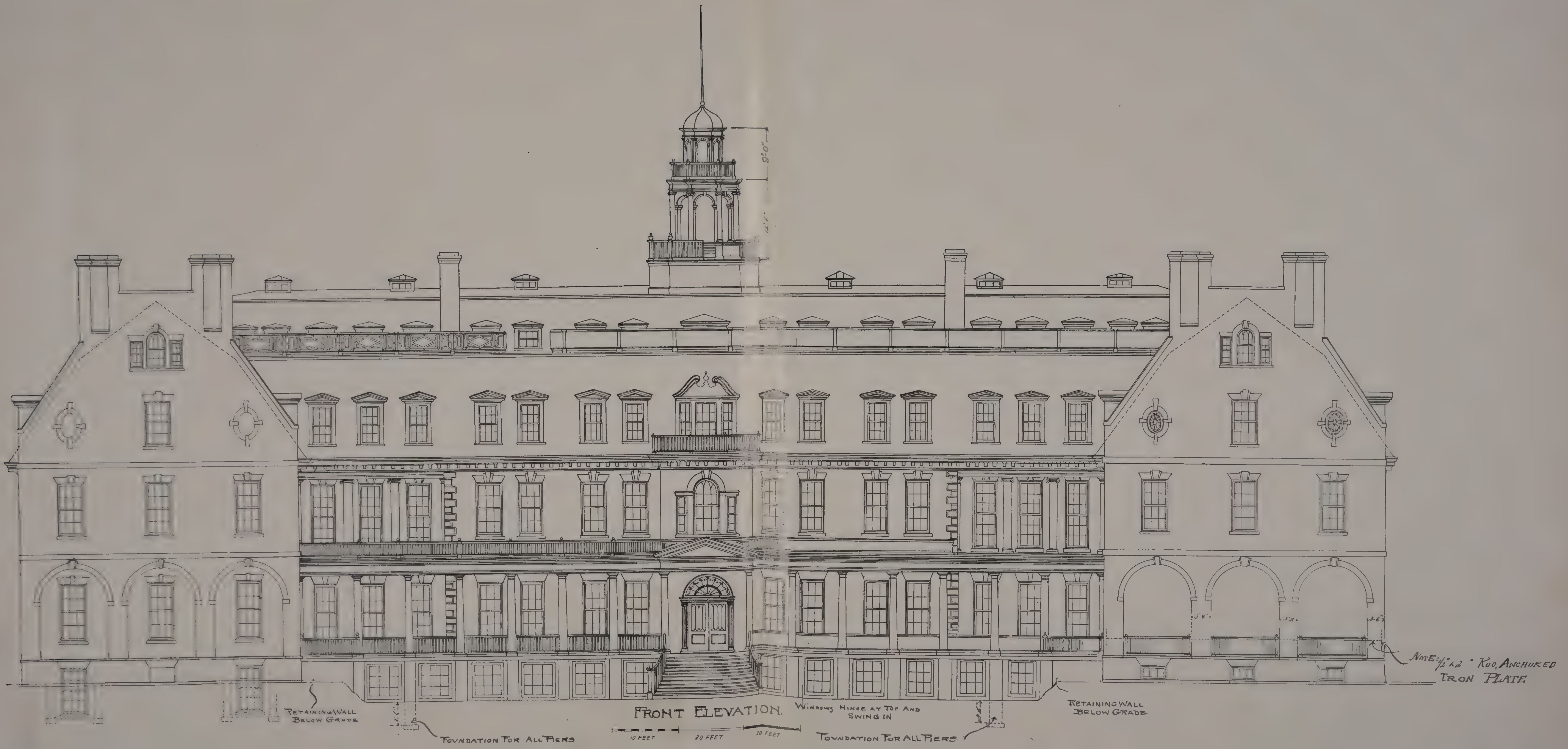
WILSON EYRE, JR., ARCHITECT.

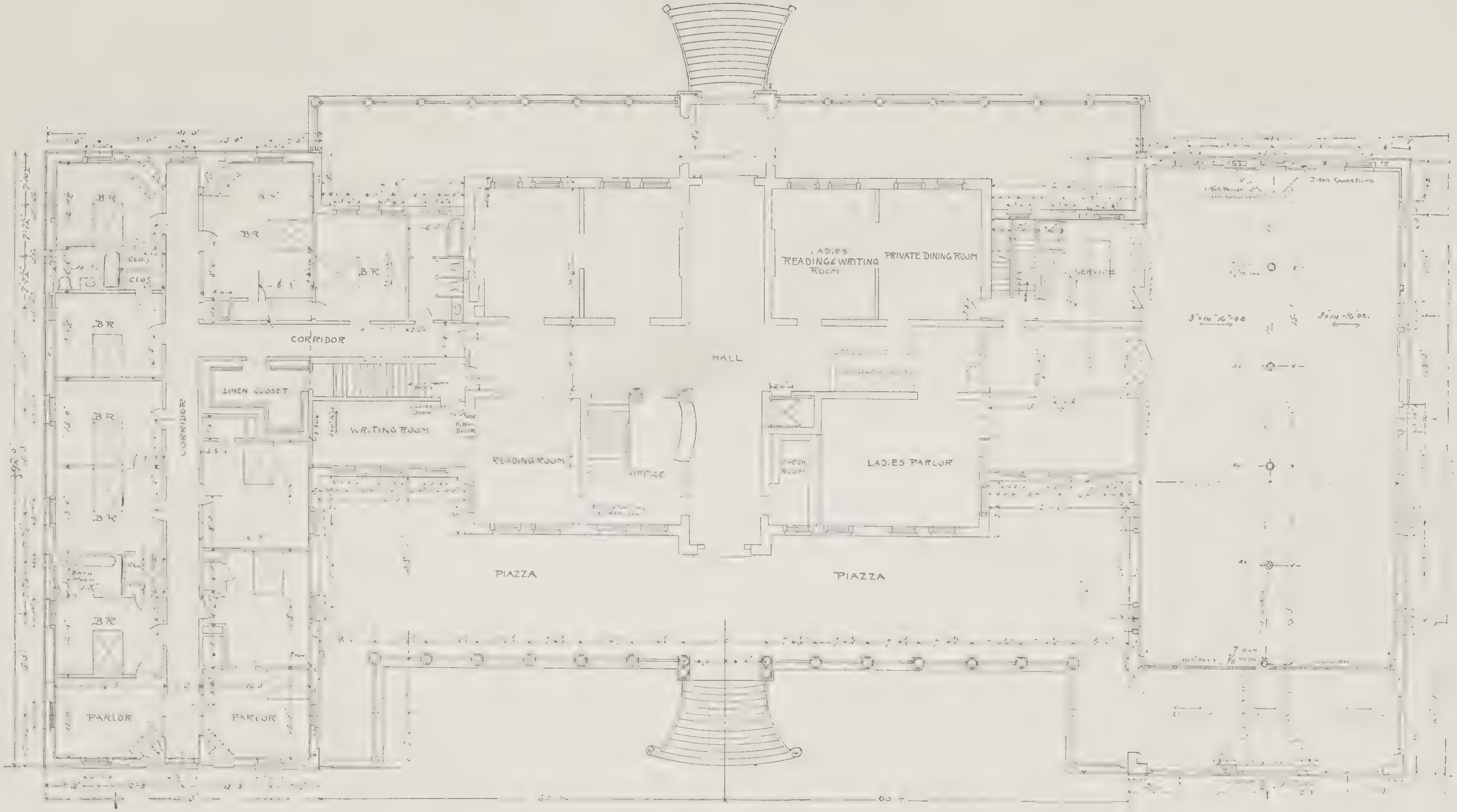


GARDEN CITY HOTEL,

McKIM. MEAD & W


9'-0"
3'-6"
3'-6"
3'-6"
NOTE: 1/2" x 2" KOO, ANCHORED IRON PLATE
RETAINING WALL BELOW GRADE
FOUNDATION FOR ALL PIERS
FRONT ELEVATION.
WINDOWS HINGE AT TOP AND SWING IN
10 FEET
20 FEET
30 FEET
FOUNDATION FOR ALL PIERS
RETAINING WALL BELOW GRADE

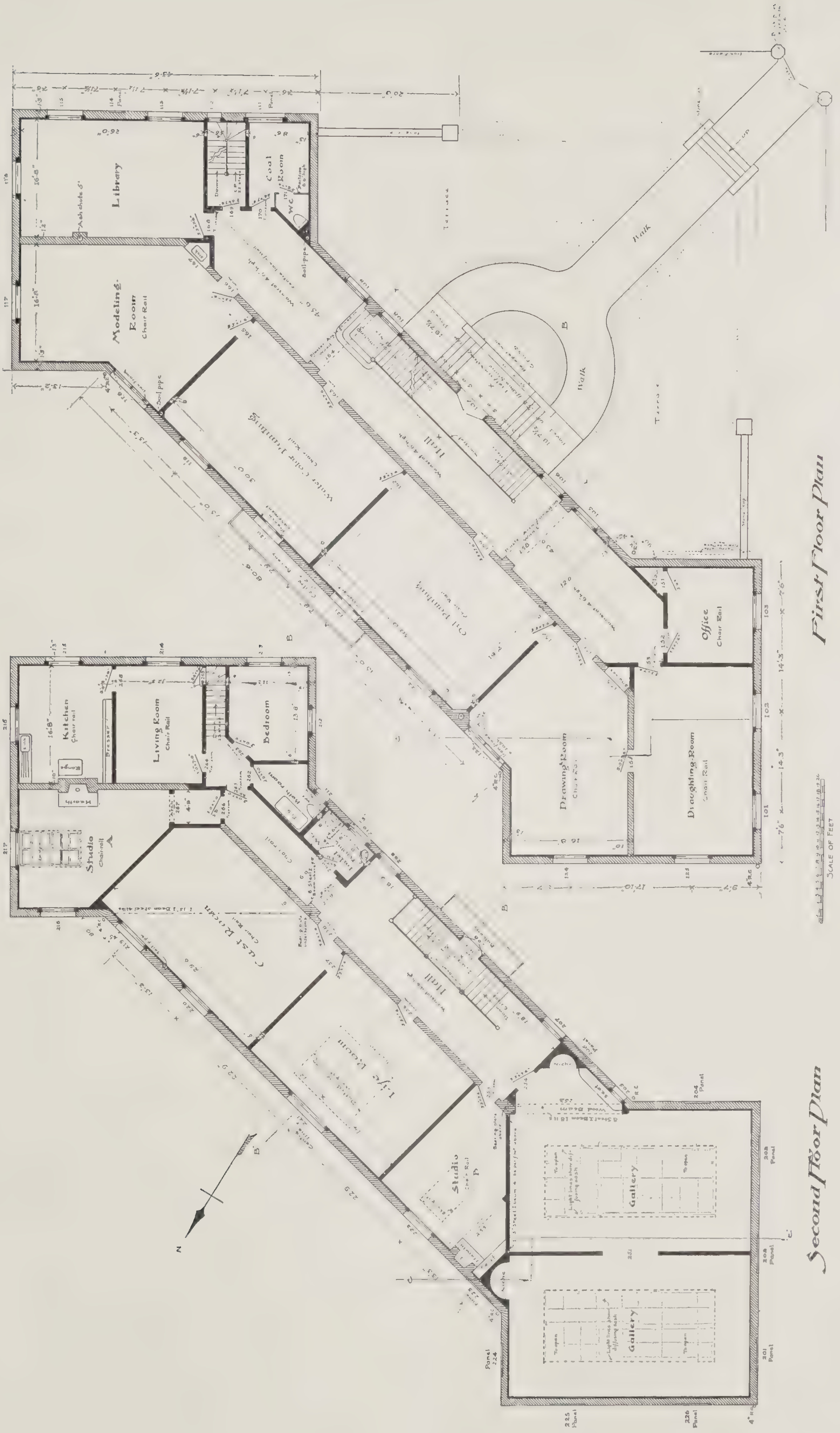
GARDEN CITY HOTEL, GARDEN CITY, L. I.,
McKIM, MEAD & WHITE, Architects.



— FIRST FLOOR PLAN —

GARDEN CITY HOTEL, GARDEN CITY, L. I.

McKIM, MEAD & WHITE, ARCHITECTS.



ART BUILDING FOR H. SOPHIE NEWCOMB MEMORIAL COLLEGE, NEW ORLEANS, LA.

WILSON EYRE, JR., ARCHITECT.

VOLVME
V
MAY
1896
No. 5

THE
BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada . . . . . $2.50 per year
Single numbers . . . . 25 cents
To countries in the Postal Union . . . . . $3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

THE recently published Report of the United States Commissioner of Labor contains a very exhaustive study of the problem of the housing of the poor, the investigations including practically all that has been done in this country and abroad. In looking over the report, it is interesting to notice the extent to which glazed brick is used in modern tenement-house construction. In the White buildings, Brooklyn, and in the structures erected by the Guinness trust in London, two of the most conspicuously successful groups of modern tenement-house construction, all of the corridors are lined, at least in the lower portions, with enameled brick, and in some cases the enameled brickwork is carried to the ceiling. Some day, it is to be hoped, a truly model tenement house will be erected, suitable for the wants, limitations, and evil propensities of the lowest and most unruly tenants. Glazed brick would form a very important feature of any such structure. Any one who has had occasion to study the tenement-house problem knows that the cheaper class of tenants will destroy everything that is not of the most durable, imperishable character. Plaster is not hard enough for the walls. They must be of some material that will not hold the dirt, and upon which a hose can be turned periodically to wash out the accumulated filth. The floors must be made of something that will not burn in the kitchen stove, and all finish must be of either iron, brick, or stone. We are so accustomed to plaster walls in this country that it is hard to imagine, off-hand, a comfortable, homelike apartment, the walls of which are finished in enameled brick or tile; but it is perfectly possible to so select the colors and shapes that a warm, pleasing effect is possible; and the glazed material would be so much more permanent and, in the long run, so much more satisfactory than a perishable material like plaster or wall paper, that, though the first cost would be relatively high, brick or terra-cotta would prove most economical.

BLACKMAIL ADVERTISEMENTS.

WE have received a letter from one of our largest manufacturers of architectural supplies, calling attention to what is quite properly styled "an epidemic of advertising schemes," from which many of the dealers in high-class building material have suffered. Our correspondent states that "hardly a day passes but that we are importuned to advertise in some souvenir, architect's portfolio, book of sketches, etc. To put it mildly, the thing is rapidly becoming annoying. These demands come to us from all over the country. In a late conversation with a leading architect, he considered the scheme was a direct insult to the profession, and that no architect of any standing should countenance it. Unfortunately, these schemes are handled by some scheming publisher, who secures a list of material men from the architect, and then proceeds to work them, at the same time insinuating with velvet touch, in case the one approached does not take kindly to his suggestion, that Mr. So-and-So would hardly feel inclined to specify his goods in the future, and here, we regret to say, the architect in most cases becomes a party to the transaction. This, it seems to us, is simply blackmail."

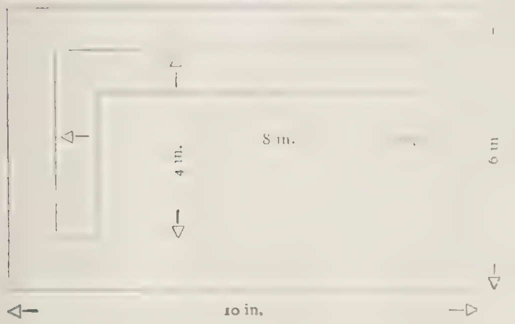
In our judgment, our correspondent uses exactly the right names. It is blackmail. And it is more vicious in its tendency for being generally unintentional. Dealers are, we believe, always inclined to give credit to an architect's good intentions; and we doubt whether architects fully appreciate how demoralizing of good intent it is for them to lend their names to mere advertising schemes, which are used in improper manner by unscrupulous agents. An architect cannot be too careful of his professional reputation, and he simply sacrifices his own influence for no return by permitting his name to be used as a lever in soliciting advertisements. We regret to say that this practise has gone to an extreme which calls for serious consideration, and it is not confined simply to a few of the minor architects, whose influence, after all, would be limited to a small circle.

Our best architects and most honored architectural societies look at this matter in a light which shows that they do not propose to be made vehicles of commercial gain by unscrupulous publishers, and we hope that the feeling may become general, both for the dignity of the profession and for the sake of the relationship, which should exist between architects and supply people.

While on this subject, there is another side which we wish to mention. We believe honor should be given to whom honor is due. Advertising is the backbone of nearly all our modern publications, and should be encouraged in every legitimate manner; but there is no good reason why architects should daily be made to suffer by the public press from a mistaken feeling on the part of the reporters and editors of our papers regarding the effect of the publicity of an architect's or a builder's name in connection with one of his buildings. We have known repeated instances where reporters have been to the architect or the builder of a prominent building, and have plainly said in so many words, that in case Messrs. So-and-So refused to pay a certain sum of money, the reporter and the editor of the said paper would make it their business to see that Messrs. So-and-So's name was not mentioned directly or indirectly in connection with the building which had just been completed. This is decidedly blackmail of the meanest and most contemptible sort. If the publication of the architect's or the builder's name is not legitimate news, it ought not to appear at all; but if it is news which is of interest to even a small portion of the readers of the paper, the name ought to appear, and in common justice to the builders and the architects, who so often are forced to assume large responsibilities with but slight remuneration and scanty thanks, it is only right that they should receive the acknowledgment of the good they have done, or the public avowal of responsibility placed where it belongs; and for a self-respecting journal to refuse to publish the names of the architects or builders, shows a woeful misconception of the feeling which we believe is most prominent on the part of the creators of our public buildings. It is not a matter of advertisement so much as of news and justice, and if the newspaper can find an excuse for publishing the names of every obscure committee man who figures in the most minute social function, or the floor walkers in every third-rate dance, there surely is no just excuse for omitting the names of the architects and builders.

The Barta Press Competition.

PROGRAM.



WE are authorized by The Barta Press, Boston, to announce a competition for designs for ornamental borders to be used in connection with display printing. These borders should be designed so that they can be adapted to various sizes of pages, and should also be of a nature which will permit of portions being used separately as head or tail pieces at the beginning or ending of paragraphs or pages; consequently, the patterns, while complete in themselves, should be such that will repeat and reverse. The average width of the pattern should not exceed ½ in., and the design should be of a sufficiently bold character to permit of photographic reproduction. The drawings must be made in line with black ink on sheets cut to a uniform size of 6 ins. by 10 ins., and the design should include a corner and 8 ins. of the pattern across the top and 4 ins. of the side, as indicated by the diagram, so as to give a complete idea of the design. For the best designs there is offered a first prize of $50; a second prize of $25; a third prize of $15; a fourth prize of $10; and a fifth prize of $5. The prizes will be awarded by a jury of three architects of acknowledged reputation. Each drawing must be marked with a motto or cipher, and a sealed envelope similarly marked and containing the full name of the designer must accompany the drawings. These envelopes will not be opened until after the award is made. After the judges have made their awards, The Barta Press shall have the privilege of selecting for their exclusive use fifteen or more of the designs that are not prize winners, for which will be given the choice of one volume of Bates, Kimball & Guild's "Details of Decorative Sculpture, French Renaissance," or "Details of Decorative Sculpture, Italian Renaissance." Drawings must be delivered flat, express or postage prepaid, at the office of THE BRICKBUILDER, not later than July 1.

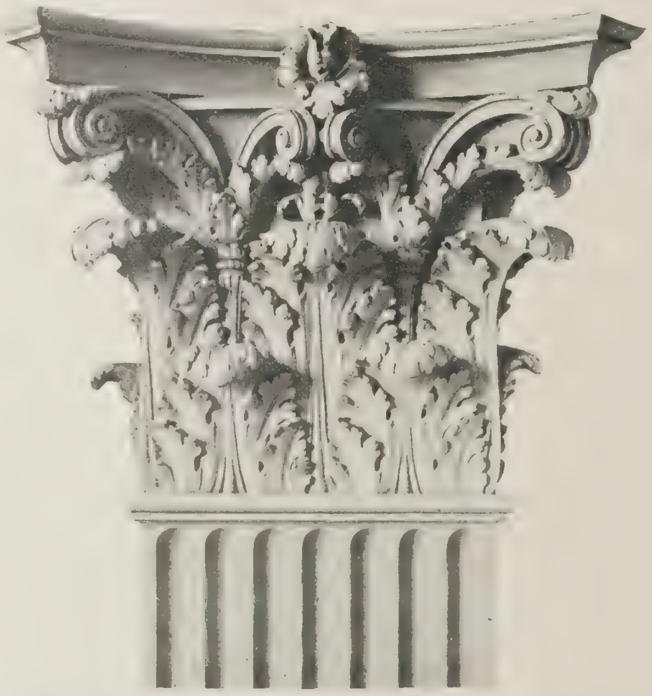
The high character of the work which is turned out by The Barta Press has been so abundantly manifested in the pages of this journal as to need little additional comment. The competitors may feel assured that their designs, if used at all, will be most scrupulously followed and all of the prize designs will be published in THE BRICKBUILDER.

REGARDING the Barta Press Competition, it should be stated that contestants have the privilege of submitting more than one design. Each design, however, should be upon a separate sheet. All designs submitted will be judged separately, and prizes awarded accordingly.

ILLUSTRATED ADVERTISEMENTS.

AN illustration of the Second National Bank, Paterson, N. J., will be found on page xxvi, and the adjoining print is from a pilaster capital, used on the same building. The basement, up to water-table, is granite, the two first stories marble, and all above that is terra-cotta and brick, both being supplied by the New York Architectural Terra-Cotta Company.

It is worthy of note that no sheet metal is used on the roof, except as flashing, and for gutters, etc. The highly ornamental hips to the mansard pavilions terminate in grotesque masks, and they in turn form part of an ornamental parapet, all of which are executed in solid blocks of terra-cotta, and are supported directly on the constructional ironwork of the roof. The same is true of the elaborate festoon ridge cresting and of the ornate chimney stacks, which together serve to heighten an already effective sky line.



Mr. Charles Edwards, of Paterson, is the architect of this, as he is of nearly all the best modern business premises in that thriving city. Notably among these may be mentioned another successful bank building, where terra-cotta is also largely used, the Paterson Savings Institution, and in which his own offices are situated.

PERSONAL.

N. S. SPENCER, formerly practising architecture in Beatrice, Neb., and Stanford Hall, formerly practising architecture in Urbana, Ill., have formed a copartnership, with headquarters in the Rugg Building, Church Street, Champaign, Ill.

S. MILTON EICHBERG, architect, formerly Lamson & Eichberg, Teutonic Building, Chicago, has removed to Suite 323, Continental National Bank Building, 218 La Salle St., Chicago.

NEW BOOKS.

FROM *Prologomenos on the Function of Masonry in Modern Architectural Structures, by R. Guastavino, Architect, 9 East 59th Street, New York.* "There are very few buildings in which the workmen apply the principles that science calls for, nor do they know the necessary rudimentary practises. For instance, a few days ago the contractor of a very important building of a public character now being erected in a large northern city of New York State said to one of the trustees: 'If the terra-cotta and the iron are delayed much longer and we are obliged to work in winter, we shall be forced to mix some lime in the cement mortar, to permit us to lay brick in cold weather.'

"It is almost impossible to conceive that responsible people will thus recommend and accept such a remedy, which is of no more value than a child's mud pies. But it is a fact that most architects in this country, where we have freezing weather from three to four months of the year, look upon such a practise with indifference and only a few of them see the absurdity of it." . . .

"At the present epoch we are so accustomed to see everything treated with nineteenth century manipulation, perhaps only to benefit intermediate trades, that very few people realize the fact that the common and most abundant materials for masonry construction are the most convenient, cheapest, and proper in the end for building purposes. The trouble is that we take too much pains in looking for expensive materials under the impression that they are the best.

"Thus we come to American architecture, which, after passing four centuries since the end of the Middle Ages, and no matter how it arose, in an anomalous way, is extending rapidly into a noble system of general construction, calling into use the three modern materials of building — Portland cement, burnt clay, and iron. These materials have been combined in such new structural conceptions that each is complementary to the others, realizing the ideals of their epoch in accordance with modern science and experience to such an extent that the architects of the time of Phidias could, we believe, endeavor to harmonize with success with the philosophy of their epoch, although yet we are far from reaching perfection, due more to the conventional engineering, iron interests, fear and lack of convictions, which will disappear in time through experience.

"We are thus in a similar position as the Romans were in the time of Augustus. We have changed the form and manner of construction from those of the Greeks, just as the Romans did, but kept the forms of the Greek as decorative suggestions, and besides, the Roman monumental forms, constructed not in a classic spirit, but in an undignified mercantile iron false construction, which is, by the way, just what the esthetics criticize the most severely."

Specifications. A Practical System for Writing Specifications for Buildings. By W. Frank Bower. Published by Edward A. MacLean, 14 Lafayette Place, New York. 1896. Price, $5.

The purpose of this work is to furnish in ready shape a correct and comprehensive skeleton from which to prepare the specifications for all the work which would enter into a building. The arrangement of the work is excellent. It begins with a complete summary of the items to be considered, arranged in the order they would naturally follow in the writing. Following this is the detailed specification, printed on alternate pages, and elaborated as far as is possible for general conditions. On the odd pages, opposite the various items, are memoranda in regard to requirements, building laws, special data, strength of materials, etc. The book concludes with a very complete index. A volume of this sort can be of considerable value to an architect, and would be of service as a reminder to the contractor who might be so unfortunate as to be called upon to figure a building "complete" upon a loosely drawn or incomplete specification. Mr. Bower has accomplished what probably every architect at one time or another had wanted to undertake, namely, a compilation or combination of all his specifications, which should include the many items which are so apt to be forgotten in actual practise or figure as extras.

THE ARCHITECT'S USE OF COLOR.

WITH the use of color you may forego moldings and projections; you get their effect by other means. With color you shall put your lights and shadows where you choose, and, like another Joshua, command the sun to stand at your bidding, and, like Orpheus, you will "have made a lasting spring." Think of whole streets vibrating with harmonies of color, like the black cliffs by the seashore that stand over deep pools of brown and green water, and the short green velvet turf outlines itself sharply against the blue sky. It is within our reach, and, moreover, is profoundly sensible. Your glazed brick or tile is a piece of permanent color, wind-proof and rain-proof, and, so far as it goes, germ-proof. I should, perhaps explain that I advocate glazed material and intense colors in the streets of manufacturing and crowded towns where there is no other color. In the country, and in those favored cities where houses have gardens, where creepers hang in rich festoons, where the exquisite laburnum shakes a merry golden tassel at the dowager lilac, and the apples have a friendly rivalry with the pear trees over the way, the local building materials will probably supply us with color enough to set off and harmonize with the palette set by Nature. But in the street, where all the color there is is of man's own making, it should be full and strong.

It has been objected that the sheen on glazed surfaces would be a serious drawback. I do not think the few examples we have show this. The upper part of a corner shop in Oxford Street was covered with white glazed tiles, — a very trying test, — but a film of "London's Entire" settled on it in a very short time, and it required some adroitness to select such a position as should show the glaze. Indeed, of glazed surfaces our own plate-glass windows should hold out undimmed longest, and yet we know, by sad experience, how often they require to be cleaned. That corner shop was a lost opportunity. We travel all the way to Pistoja to see John Robbia's colored terra-cotta frieze to the hospital there; we pass by unremarked the frieze of uncolored terra-cotta to Heath's hat shop.

As to cost, the money wasted in idle profusion of column and balister and carving would defray the extra cost of a faience front, treated in sober common sense. As to the architect's use of color, what can be said beyond that his use of it should be large and broad? Indoors your color may be in picture form if you please; but out of doors you require effect, not detail — bands, diapers, amongst which the windows locate themselves without regard to pattern or symmetry. The pattern is valuable merely as a convenient system of gradation. Not that this should be held the final ideal of outside coloring: we may in time reach the modeled figures of Susa, our buildings clasped and fortified by allegorical supporters; we might impress to our service the romance and portraiture of our time.

Part of Jesus College, Cambridge, was built in many-colored bricks four hundred years ago. To describe the beautiful fusion of iridescent tints that Time's fancy has occupied itself in mingling, one must use the word "opal." The black headers have borrowed of the sky, of the grass, of their neighbors, and gleam as dark blue, green, and purple topazes; the yellow has borrowed of the red, and the red has taken toll of the yellow, till, under scrutiny, the pattern becomes shy and refuses to let itself be traced, though at half glance it seems obvious enough. The lichens contribute the russets, grays, and gold. In this gay heraldry the windows occur quite simply, and their quietude enforces the splendor of their setting. When our descendants shall be heading their letters with the year 2000 and more, they will treasure amongst their possessions at Oxford of the Middle Ages this amazing jewel of our own times. — *Halsey R. Ricardo, in the British Architect.*

THE article by Mr. George Hill on Fire-Proof Floor Arches, which is resumed in this number, will be concluded in the June or July number. The closing chapters of this series contain some thirty-three illustrations of the tests that have been made under Mr. Hill's directions.

The Resistance of Brickwork.

SOME very interesting and valuable experiments have recently been made in England under the direction of the Royal Institute of Architects, with the object of determining the resistance to crushing of brick piers.

The tests were made under the supervision of the Science Standing Committee of the Institute, consisting of Messrs. Burrows, Street, and Clarke, and Professor Unwin. The names of these gentlemen are so well known throughout the architectural world as to give an added value to the results of the tests. Fig. 1 is a diagram illustrating the construction of the machine in which the piers were tested, which consisted essentially of two wrought-steel riveted columns, connected above and below by heavy riveted plate girders. Upon the lower girder was placed a hydraulic ram 3 ft. 1⅞ ins. in diameter, and of 1,130 sq. ins. in area. In order to determine the true crushing effect of the ram due to any gauge pressure, careful preliminary tests were made by crushing cylinders of copper of very uniform quality, which had previously been tested in one of the technical colleges, and the compressions corresponding to different loads accurately determined. This was quite essential, as in the case of so large a ram it was quite probable that a considerable amount of gauge pressure would be expended in mere friction. In fact, the preliminary tests showed that the loss in this respect ran up considerably over 10 per cent. for loads of 50 tons.

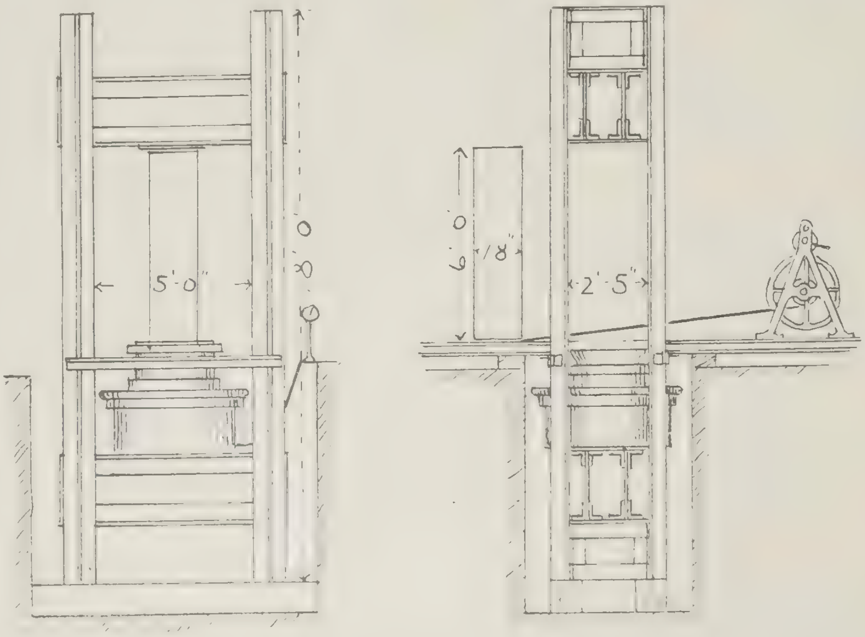


FIG. 1. TESTING MACHINE.

The upper part of the ram was provided with a cup and ball bearing, upon which the brick piers were placed, bearing directly against the under side of the upper girder. The whole of the steel work of the machine was so proportioned that a pressure of 500 tons could be safely exerted on any specimen, this corresponding to a water pressure of about 1,000 lbs. to a square inch.

The experiments finally decided upon were confined to the following varieties of brick, as affording types of the best kind most generally found in England: —

1. London stocks.
2. Gault.
3. Leicester red.
4. Staffordshire blue.

London stocks are yellow brick, hand-made; quite an ordinary brick, and, we should say, by rough comparison, about like what we call light hards in this country. The Staffordshire blues are hard, well-burned bricks, machine pressed.

The piers were built upon wrought-iron plates 2 ft. by 2 ft., 6 ins. by ½ in., resting upon a line of rails leading directly to the testing machine, so that they could be drawn into the machine without being disturbed. Two piers of each kind of brick were tested, the bricks in one being laid up in Portland cement mortar, and the bricks in the other in gray lime mortar. The cement mortar was mixed by measure in the proportion of 1 of cement to 4 of washed river sand; and the lime mortar, 1 to 2. Each pier was about 18 ins. square and 6 ft. high. The brickwork was started upon a bed of mortar of the thickness of an ordinary joint, and was finished with a layer of mortar, upon which a sheet of felt was laid to prevent the top courses deteriorating from heavy rain, the work all having apparently been done in the open. It is interesting to note that, notwithstanding the care taken in building these piers, the committee in charge experienced the very difficulty which is the constant worriment of the architect in actual practise. The labor was supplied by a large firm of contractors. During the absence of members of the committee, the bricklayers, finding the Leicester red and Staffordshire blue bricks very hard to cut, filled in a great portion of two piers with closers of London stocks which quite destroyed the value of the piers, so that fresh ones had to be built.

After making the first test it was discovered that the head of the testing frame was not perfectly true, and a lead casting was made to fit the concavity, held in place by sheet iron and iron clips. Also on the head of each pier tested there was placed a sheet of felt and one of iron 1-16 in. thick, so that the pressure may be considered to have been fairly well distributed.

All of these tests are very fully reported in the *Journal of the Royal Institute of British Architects*, together with a mass of material and data which is exceedingly interesting in many respects. The following table will illustrate the thorough manner in which all the tests were made.

PIER NO. 15. STAFFORDSHIRE BLUE BRICKS, FROM ROWLEY REGIS, IN CEMENT MORTAR, WIRE CUTS, NO FROGS.

6 ft. high, 13½ x 13½ ins.; sectional area 1.265 sq. ft. Built 1st August; crushed 31st December. Age, 21.7 weeks.

TIME.	Pressure on Gauge. Pounds per Square Inch.	Total Real Pressure in Tons.	Pressure per Square Feet of Pier in Tons.	Compression in Inches	NOTES.
12.25	10	.14	.11	. . .	Bearing tight before starting.
12.28½	70	27.29	22.12	. . .	Sounds of cracking heard.
12.29½	90	37.26	29.45	. . .	Cracking top three courses.
12.30	110	46.54	36.79	3/16	
12.30½	120	51.18	40.46	¼	Cracking top five courses.
12.31	130	55.82	44.12	5/16	Cracking at bottom.
12.32	160	69.74	55.13		Cracking at bottom, five courses.
12.32½	180	79.02	62.46	⅜	Two cracks at bottom, six courses up.
12.33	200	88.30	69.80	7/16	Crack, ten courses down from top.
12.33½	210	92.94	73.47	. . .	Crack opening top and bottom.
. . . .	220	97.58	77.13	½	
12.34	230	102.22	80.80	9/16	Pier splitting up.
12.35	240	106.86	84.47	¾	Crack well opened, and pier broke entirely into a heap of rubbish. Not a whole brick could be found. Cement was still damp.

The following is a comparative statement of the results of all the tests. It should be borne in mind that these represent the results of a first series of experiments. All the piers were from twenty to twenty-two weeks old, during which time the mortar had a chance to thoroughly set. A subsequent set of tests are to be made on piers which have set up for ten months, the results from which will be watched with a great deal of interest.

COMPARATIVE STATEMENT OF RESULTS.

No. of Pier.	Description of Brick.	Age.	Commencement of Failure.	Final Collapse.
		Weeks.	Tons per Square Foot.	Tons per Square Foot.
*1	London Stocks in mortar (with a frog) .	17.7	....	....
2	London Stocks in mortar (with a frog) .	18.3	4.18	10.41
3	Gault in mortar (without frogs)	18.3	5.00	21.82
4	Gault in mortar (without frogs)	18.8	6.16	22.03
5	Leicester Red in mortar (without frogs) .	19.1	15.20	29.93
6	Leicester Red in mortar (without frogs) .	18.6	16.11	31.55
7	Staffordshire Blue in mortar (without frogs)	18.6	22.43	69.22
8	Staffordshire Blue in mortar (without frogs)	19.4	21.42	79.39
9	London Stocks in cement (with a frog) .	21.1	7.22	16.03
10	London Stocks in cement (with a frog) .	21.0	5.72	13.83
*11	Gault in cement (without frogs)	21.0	6.98	17.98
*12	Gault in cement (without frogs)	20.5	7.08	17.51
13	Leicester Red in cement (without frogs) .	22.1	17.87	67.36
*14	Leicester Red in cement (without frogs) .	21.7	21.82	49.54
*15	Staffordshire Blue in cement (without frogs)	21.7	29.45	84.47
*16	Staffordshire Blue in cement (without frogs)	22.7	16.91	61.14

Duplicates of the piers marked * have been built, and will be tested for the four months' period.

Tests were also made of the strength of the individual bricks as well as of lime and cement briquettes, mixed in same manner as the actual mortar used in the piers. The strength of the bricks is as follows: —

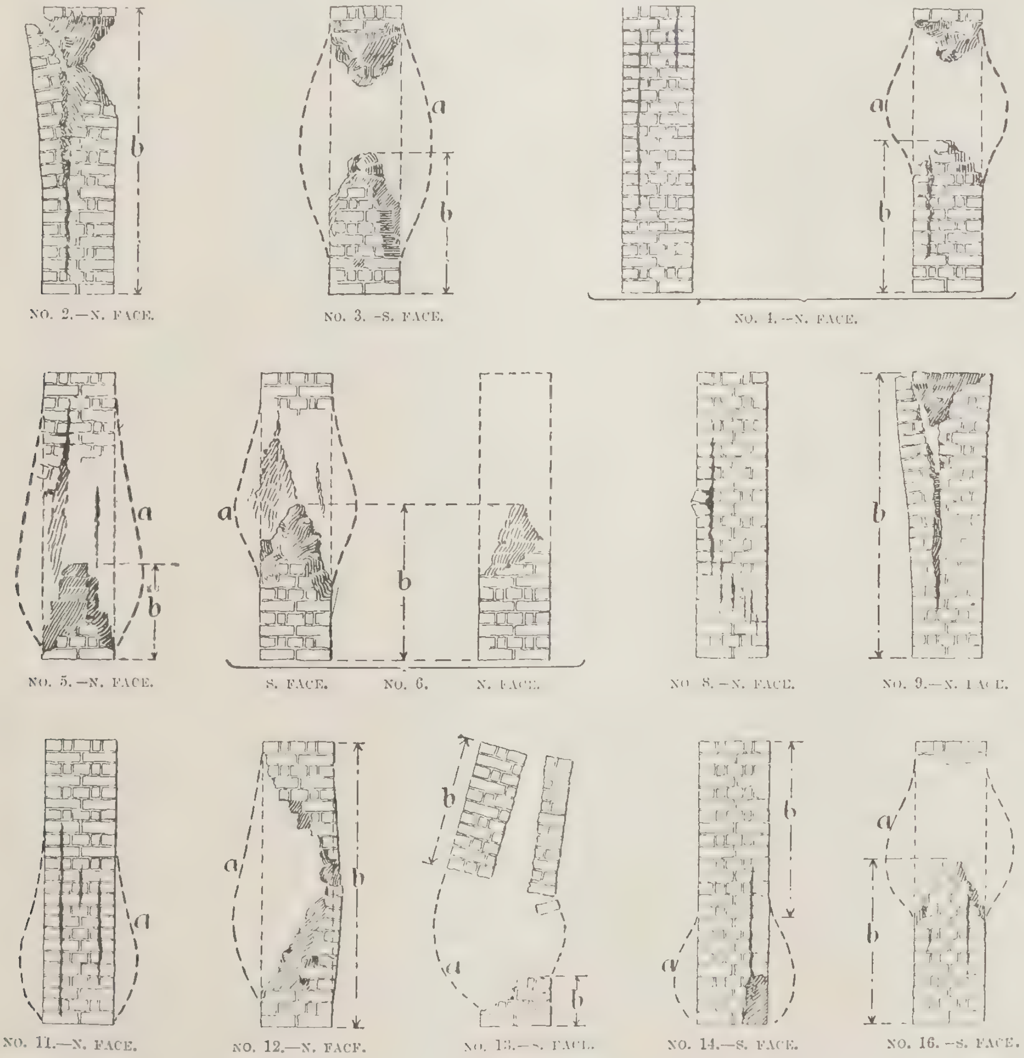
	Crushing strength in tons per square foot.		Crushing strength in tons per square foot.
London Stocks . .	84.27	Leicester Red . . .	382.1
Gault	182.2	Staffordshire Blue. .	701.1

These strengths were ascertained by Professor Unwin by his tests at the Central Technical College, where were also tested the briquettes with the following results: —

LIME BRIQUETTES. Strength at 4 weeks, 6.08 tons per sq. ft.
Strength at 12 weeks, 8.73 tons per sq. ft.
Strength at 24 weeks, 15.72 tons per sq. ft.

CEMENT BRIQUETTES. Mean strength of briquettes made with same sand as that used in building the piers, 29.00 tons per sq. ft. at 24 weeks.

The diagrams in Fig. 2 were reproduced from drawings made on the spot by Mr. Matt. Garbutt. In his report, Mr. Garbutt states that "The observed effects of pressure were similar in most cases, but varied in degree with the different materials. Generally the first evidences of strain were slight internal crackling sounds, audible only on applying the ear to the brickwork. Then the mortar squeezed out of the joints and fell off — this occurring to a greater extent with the harder bricks, and being more marked where lime mortar was used than with cement. This was accompanied or followed by cracks occurring in single bricks which, from slightly irregular bedding, or other cause, were unevenly stressed, and by the spalling off of small corners or pieces of the face for similar reasons. By this time, the joints were generally noticeably compressed, and serious cracks,



NO. 2.—N. FACE. NO. 3.—S. FACE. NO. 1.—N. FACE.

NO. 5.—N. FACE. S. FACE. NO. 6. N. FACE. NO. 8.—N. FACE. NO. 9.—N. FACE.

NO. 11.—N. FACE. NO. 12.—N. FACE. NO. 13.—S. FACE. NO. 14.—S. FACE. NO. 16.—S. FACE.

a . . . a, Approximate outline during final collapse. *b . . . b*, Portions which remained in shape after collapse of pier. Approximate scale of 4 ft. to 1 in.

FIG. 2. DIAGRAMS SHOWING WAYS IN WHICH PIERS FAILED.

Reproduced from illustrations in the *Journal of the Royal Institute of British Architects.*

indicating final lines of rupture, appeared. The piers at this point generally bulged outwards, slowly at first, and then, the resistance of the brickwork ceasing, the falling of the pressure gauge gave warning that actual collapse was imminent. In the case of the harder bricks set in cement the final failure was much more sudden than in the others, so much so that some agility was necessary on the part of the man who, to measure its compression, stood close to the pier. It will be desirable, before carrying out the proposed nine-month tests, to devise an instrument for measuring, without undue risk to the observer, the actual shortening of the piers during testing."

Pier No. 15, the results of the test of which we have previously quoted, was only 13½ ins. square. Being smaller than the others, it was feared the machine would not have sufficient power to crush the Blue bricks in cement. It was found to be 25 per cent. stronger in proportion in its area than the 18 in. pier, the difference being probably due to the better bonding and absence of closures. It failed entirely by crushing, and was so completely destroyed that not a whole brick remained. The cement was still damp at the time of failure.

Judging from the discussion which took place in the Royal Institute following the presentation of the reports of the committee which conducted the foregoing tests, it would seem to be evident that either we overload our brickwork in this country, or else brick masonry in England is of a very low comparative order. Professor Unwin, in the course of his remarks, stated that according to the best of his knowledge the limits of working stress which have been allowed in English brickwork in cases where it is required to carry a heavy load are something like this: —

For bricks in lime mortar, not more than from 2 to 4 tons per square foot.

For bricks in cement mortar, not more than from 4 to 7 tons per square foot, and for specially selected hard brick in cement mortar, from 7 to 8 tons per square foot.

It will be seen that the maximum strength, according to Professor Unwin, which is permissible upon English brickwork, only equals what we put upon the very poorest kind of brickwork in this country. It was further stated that the factor of safety in brickwork should be about 20. This ratio in piers, such as the one reported in detail, would indicate a maximum safe load of only 4.2 tons, or, as all the reports of the English tests are made in tons or 2,240 lbs., the equivalent strains in American tons would be 4.7 tons per square foot. This, be it understood, is for a construction which employed a very hard brick having an ultimate crushing resistance of from 600 to 1,000 tons per square foot, and which is laid up in cement mortar; whereas in Boston, with light hard bricks, which generally means pretty poor brick, too, and laid up in lime mortar, we are supposed to be perfectly safe when we load with nearly 5 tons per foot. Either the American practise is wrong, or the English brick and mortar makers are wofully at fault. In nearly all the tests it was found that the first yielding was on account of the mortar being squeezed out of the joints, and yet the resistance of the lime mortar briquettes ran up to nearly 16 tons per square foot. It is interesting to note that Professor Unwin, in speaking of the tests of brickwork, admits that the American brick is very much stronger than what is used in England, and another speaker following him, Mr. Walker, author of "Brickwork," testifies that American bricks are infinitely better and much harder, as a rule, than English brick.

The Boston building law, which was prepared entirely under the direction of perfectly competent experts, allows stresses in tons of 2,000 lbs. per square foot as follows: —

First-class work, of hard-burned bricks, and including piers in which height does not exceed six times the least dimensions, laid in —

(*a*) One part cement, two parts sand	15
(*b*) One part cement, one part lime, and eight parts sand	12
(*c*) Lime mortar	8

Brick piers of hard-burned bricks, in which height is from six to twelve times the least dimension.

Mortar "a"	13
Mortar "b"	10
Mortar "c"	7

For "light hard" bricks, stresses not to exceed two thirds of above.

Let us compare some of the results which have been obtained by testing of individual bricks. In THE BRICKBUILDER of November, 1894, was reported the results of some tests made at Watertown upon some Eastern hydraulic pressed bricks. The tests were made upon single bricks, the pressed surfaces being faced with plaster of Paris to secure even bearings in the testing machine. The average of twelve tests on whole bricks showed an initial yielding at 10,755 lbs. per square inch, or 775 tons per foot, with ultimate strength of 950 tons per foot. There were also a number of tests made in 1887 and 1888 by a committee of the American Society of Civil Engineers. These tests were quoted in the *Journal of the Royal Institute*, and the results were reduced to the English standards. The bricks themselves were of three kinds: —

	Crushing strength. Tons per square foot.
Hard burned face bricks	890
Hard burned common bricks	1170
Bay State medium bricks	730

Thirty-three brick piers were built of these bricks of various forms and sizes, and were all tested at Watertown. The results of the tests are given by the following table: —

BRICK PIERS IN CEMENT MORTAR.

Kind of Brick.	MORTAR.	Form of Pier.	Nominal Size in Inches Square.	Area of Section in Square Feet.	Height in Inches.	No. of Courses.	Thickness of Joints.	Age in Months.	Crushing Pressure in Tons per Square Foot.
Common	1 Portland, 2 sand	Solid.	16	1.56	121	49	¼	24	121
Common	1 Portland, 2 sand	"	12	0.95	120	58	¼	24	128
Face	1 Portland, 2 sand	"	12	0.91	119	51	3/16	23½	144
Face	1 Portland, 2 sand	"	8	0.40	80	35	⅛	23	144
Face	1 Portland, 2 sand	"	12	0.92	23½	10	⅛	18½	234
Common	1 Portland, 2 sand	"	16	1.77	23½	13	¼	18½	Not given.
Bay	1 Rosendale, 2 lime, 6 sand	"	12	1.00	73⅝	30	3/16	20½	105
Bay	1 Rosendale, 2 sand	"	12	1.00	72½	30	3/16	20	126
Bay	1 Portland, 2 sand	"	12	1.00	72⅝	29	3/16	20	115
Bay	1 Portland, 2 lime, 6 sand	"	12	1.00	73¾	30	3/16	20½	91
Bay	Neat Portland	"	12	1.00	72	30	3/16	19½	152

BRICK PIERS IN LIME MORTAR (1 LIME AND 3 SAND).

Kind of Brick.	FORM OF PIER.	Nominal Size in Square Inches.	Area of Section in Square Feet.	Height in Inches.	No. of Courses.	Thickness of Joints.	Age in Months.	Crushing Pressure in Tons per Square Foot.
Face	Solid	8	0.395	....	7	....	15	163
Common	Solid	8	0.420	....	7	....	15	156
Face	Solid	12	0.92	....	10	....	18½	125
Face	Hollow (Space 4½ x 4¼)	12	0.79	....	10	....	18½	128
Common	Solid	12	0.96	....	10	....	18½	138
Common	Hollow (Space 4½ x 4½)	12	0.83	....	10	....	18½	131
Bay State	Solid	12	1.01	....	10	....	18½	88
Bay State	Solid	12	1.00	72½	30	3/16	19½	73
Bay State	Solid	12	1.00	72¼	30	3/16	20	85
Bay State	Solid	12	1.08	73	19*	⅛	20	78
Face	Solid	8	0.40	80	35	⅛	23	120
Bay State	Solid	12	1.00	94¼	39	3/16	23½	75
Bay State	Solid	12	1.00	119⅝	49	3/16	23½	59
Common	Hollow (Space 4¾ x 4¾)	12	0.80	120¾	50	¼	24	101
Common	Solid	12	0.96	117⅝	49	¼	24	76
Face	Solid	12	0.92	119⅞	52	⅛ to 3/16	24	97
Face	Hollow (Space 4 1/10 x 4 1/10)	12	0.80	119⅛	52	⅛	24	115
Bay State	Solid	12 x 16	1.33	120½	49	¼	24	50
Bay State	Solid	8 x 12	0.66	120¾	49	¼	24	60

* On edge.

Mr. F. E. Kidder also made a number of tests in 1882 at Watertown, in behalf of the Massachusetts Charitable Mechanics Association, the results of which are published in his handbook. The piers were 8 in. by 12 in. and nine courses, about 22½ ins. high, and the tests were made when the piers were four months and twenty-six days old, about the same age as the London tests. The following table gives the results of the tests: —

8 IN. BY 12 IN. PIER. COMMON BRICKS LAID IN	Ultimate strength of pier.	Pressure per square inch under which pier commenced to crack.	Ultimate strength per square inch.	Tons per square foot.
	lbs.	lbs.	lbs.	
Lime mortar	150,000	833	1,562	112
Lime mortar, 3 parts; Portland cement, 1 part	290,000	1,875	3,020	217
Lime mortar, 3 parts; Newark and Rosendale cements, 1 part	245,000	1,354	2,552	184
Lime mortar, 3 parts; Roman cement, 1 part	195,000	1,041	2,030	146
Portland cement, 1 part; sand, 2 parts	240,000	1,302	2,500	180
Newark and Rosendale cements 1 part; sand, 2 parts .	205,000	708	2,135	153
Roman cement, 1 part; sand, 2 parts	185,000	1,770	1,927	148

One cannot study the foregoing tables and the results of the British experiments without being struck by the wide variation in results; and the tests of the Society of Civil Engineers seem also to indicate that, on the whole, the quality of the mortar is not an essential element of the strength of the pier, for the average resistance of a pier laid up in Portland cement mortar is 147½ tons per square foot, while the average of piers laid in lime mortar is about one hundred tons. The difference is far less than one would suppose, judging from the results of tests on lime and cement mortar without the bricks. The fact is, the chief role of mortar in a masonry construction is to serve as a matrix for the bricks, and all of these tests emphasize the necessity of the joints being evenly and fully filled. The report of the English tests calls attention to the preliminary cracking noise when pressure was applied upon the piers, indicating a gradual subsidence of the irregularities caused by mortar not being properly applied. It would, of course, be impossible to reason out the strength of the pier from the resistance of the individual brick. It would also be equally inadvisable to reason out the strength from the resistance of the mortar itself. It is probable that had the tests of the Society of Civil Engineers been made upon larger piers, the unit resistance of the brickwork would have been greatly reduced, for it seems to be a pretty well established fact that a small pier is much stronger per square foot than a large one, due, undoubtedly, to the impossibility of getting an even bearing and even distribution of the weight over a large surface made up of a number of small parts.

The comparative tests, both English and American, show that the average English brickwork is not as reliable as corresponding work in this country. The London Stocks brick is not of sufficient strength to be used safely in any building under such conditions as prevail here, and the best of the bricks quoted do not give as good results as we obtain from our common hard-burned bricks. On the other hand, it is to be doubted if brickwork as habitually laid by our masons, if loaded to the limits allowed by our Boston building law, has a factor of safety of more than 4 or 5. It surely hasn't anything like the factor of 20, which Professor Unwin recommends, and before we can speak with surety upon how much it is safe to trust our brickwork with, there must be more exhaustive tests conducted in a similar manner to those which have been quoted from abroad, but upon piers at least 2 ft. square. This would require a testing machine of a capacity of at least 1,000 tons. Such a machine does not exist anywhere, and could not be constructed so as to be of scientific value without a great expense. So that, until some person or some society is ready to make tests of this sort and has the proper funds at their disposal, we shall have to be content with trusting very largely to luck in our masonry construction, if we are to load it up to the limits which in this country seem to be considered safe.

C. H. BLACKALL.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

FIRE-PROOF FLOOR ARCHES.

BY GEO. HILL, C. E. (*Continued.*)

CLAY ARCH TESTS.

THE author designed a hydraulic transverse testing machine, which was built for him by the Watson & Stillman Hydraulic Works, in the following manner (see Fig. 29a): A 15 in. I beam, 80 lbs. per foot, 7 ft. 9 ins. long, was used as the principal member. It was supported above the I beams, which form the skewbacks of the arches by means of two pairs of wrought-iron clamps. On one end of the large beam a small hydraulic pump was placed, and connected to the pump by a long coil of copper pipe was a ram for putting pressure on the arch. The pump was ⅞ in. in diameter of piston and 2¾ ins. stroke, and one man could get a pressure of 1,500 lbs. per square inch, or 75,000 lbs. on the arch, quite easily. It was one of the standard Watson & Stillman pumps with brass valves, and never gave the slightest trouble. Once in the middle of the test some sticks became mingled with the oil which was used instead of water in order to prevent freezing, and one of these small sticks lodged under the valve; the valve was taken out, cleaned, and replaced without any difficulty whatever. The ram was of 7 in. stroke, about 8 ins. in diameter, and exactly 50 sq. ins. in area, and had the bottom crowned about ⅝ in. It was set in a cast-iron body and was packed with leather. It was arranged to hang on the under flange of the 15 in. I beam by means of a couple of clamps, which could be tightened on it, and could be slid along to any desired position on the beam. To the upper part of the chamber of the plunger a set of three valves was connected, to which three Bristol pressure-recording gauges were attached. One had a range of 3,000 lbs., one of 1,500 lbs., and one of 400 lbs. per square inch. The readings were, therefore, to be multiplied by the area of the piston, or 50, to get the actual pressure exerted. The dials were rotated by clocks, making one revolution per hour, and so both the amount and the rate of the application of the load were recorded graphically. Two gauges were used in conjunction at all times, thus checking one another. In the tests made they always agreed closely.

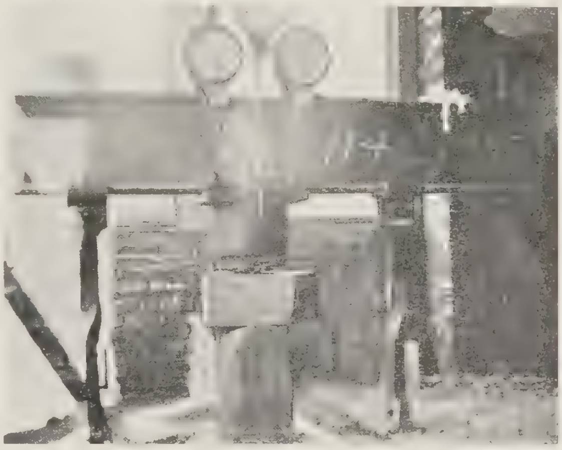


FIG. 29a.

Tile Arch Tests.— These were tests of a series of arches, some of which were built at the works of the Staten Island Terra-Cotta Lumber Company, but the majority by the Raritan Hollow and Porous Brick Company, at various times during the winter of 1894–95 and the summer of 1895.

Test No. 76.— This was made on a hollow tile end-construction arch 7½ ins. deep and of an effective depth of about 6 ins., made of hard tile and laid up without any mortar, one block wide. This arch is shown in Fig. 30. The clay blocks were fitted in place over a temporary center and then the key block put in and wedged as well as it could be, but owing to irregularities of the material this could not be very satisfactorily accomplished. The pressure was continuously applied, and at 5,000 lbs. the key at the upper portion split in a plane parallel with the tie-rod. At 6,250 lbs. the skewback on the right-hand side cracked, and a spall flew off the middle voussoir on the right-hand side of the key. At 9,000 lbs. the arch failed along the wavy lines shown. The application of the load was by means of planking leveled up with sawdust over the top of the arch, so as to effect a practically uniform distribution of the loading.

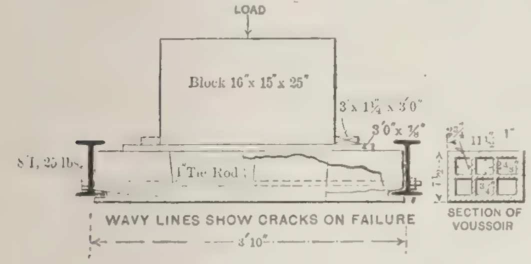


FIG. 30.

Test No. 77.— This was of a side-construction or old style arch laid up dry like No. 76, and of hard tile. Its construction is shown in Fig. 31. The pressure was applied as shown, there being a slight leveling of sawdust under the planking. There was no perceptible effect until the load reached the maximum of 2,500 lbs., when the arch suddenly collapsed by shearing off the voussoir next the skewback at the point shown. The arch was composed of one course of voussoirs laid up dry; the load was practically uniformly distributed.

Test No. 78.— This was similar in all respects to No. 77, except that in this case, not only the voussoir next the skewback, but the skewback itself, failed by shearing.

Test No. 79.— This was of a hard tile end-construction arch which had been built for some time, and had for several months carried a pile of brick weighing 12,000 lbs. uniformly distributed over it. A little sand was sprinkled over the top, and the load was applied over an area of 9 by 48 ins., or 3 sq. ft., in the center. The point of application of the load was over one of the central longitudinal divisions, and as each one of the blocks composing the arch was about 1 sq. ft. in area, two rows of blocks received the loading. As the load was applied the arch continually deflected until the maximum of 13,750 lbs. was reached, after which continued pumping resulted in a decrease in the amount of the load. The cracking of the various courses is shown in Fig. 32, which does not, however, show how markedly the top horizontal section of the arches was sheared off, showing that it acted truly in compression. There was a certain amount of elongation of the tie-rods, but they remained intact. This arch had an effective depth of 4 ins., the balance being below the skewback, and acting simply as fire-proofing for the upper section. In a plane perpendicular to the line of pressure, the section through the arch would show a top horizontal and a bottom horizontal member, a middle horizontal member, and in each block three or four vertical members. The arch was laid up in a mixture of one part Portland cement and two parts sand, and over the top of it was a leveling of the same mortar about ½ in. thick; when taken off, chips of the blocks adhered to this, showing that the tile section was reinforced by about this same amount.

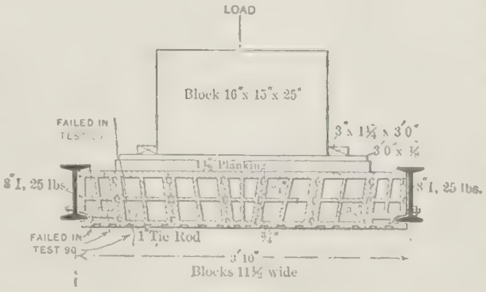


FIG. 31.

Test No. 80.— This was of an end-construction arch, nominally 10 ins. deep, and of 5 ft. 5 ins. span, 4 ft. 2 ins. wide, with an effective depth of about 7¾ ins. The tie-rod was so placed as to be 2½ ins. above the bottom, thus reducing the distance from the center of the tie-rod to the top of the arch to 6 ins. The section of the voussoirs, which were of hard tile, is shown in Fig. 33. Blocking was so placed over the arch as to distribute the load uniformly over it, and then the pressure was gradually applied until the machine clamp broke at 57,500 lbs. At 40,000 lbs. a slight crack appeared in the bottom of one of the skewbacks running out horizontally from the bottom. At 40,500 lbs. the bottom of the joint of the key block on the left-hand side opened ⅛ in., and on the right-hand side it opened $\frac{1}{16}$ in. At 42,500 lbs. the top began to spall a very little at the center. After the clamp broke the cracks on the arch all closed, and the only evidence that it had been subjected to load was a spall the size of a thumb-nail at the top corner of one of the blocks, and a small crack at the skew in one of the others. This arch was laid in Portland cement mortar, and had set twenty-four hours when tested, but the temperature had been so low that the mortar had frozen.

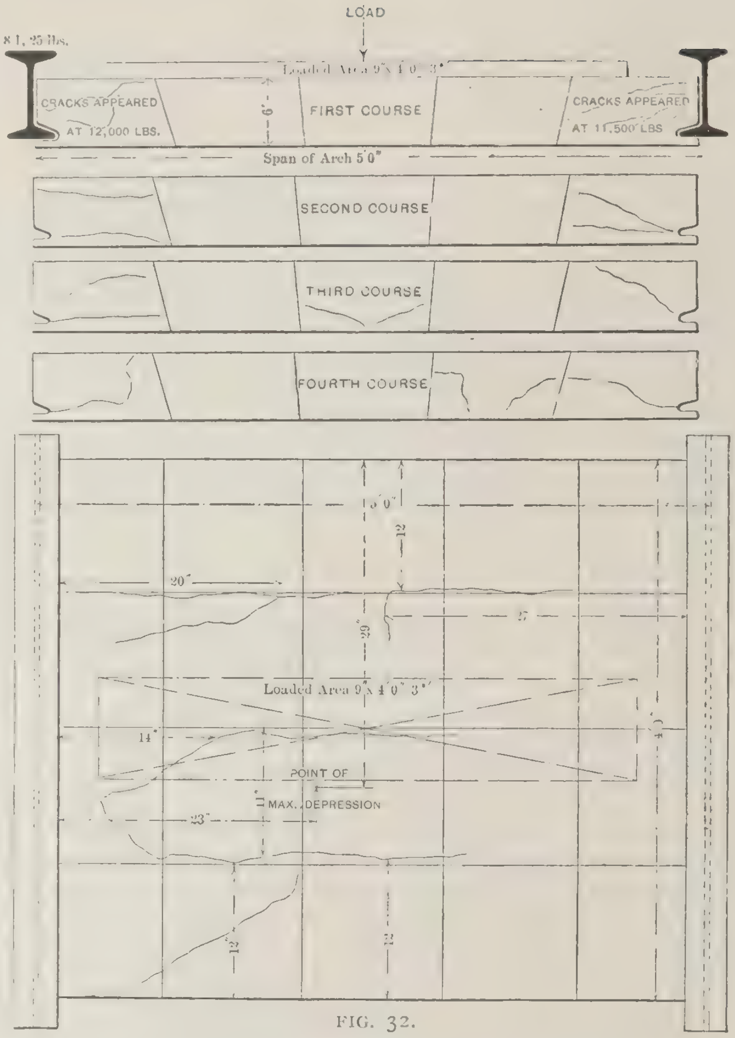


FIG. 32.

Tests of Arches Built for the Purpose.— Table No. 3 gives the weight and composition of these arches. They were laid up in a strong Portland cement, and had about three months in which to set.

TABLE NO. 3.— SPECIAL ARCHES FOR TESTING.

TEST NUMBER.	81	82	83	84	85	86	87	88	89
Depth of block, inches	8	8	8	8	10	10	12	8	8
Weight of block alone per square foot, pounds	31.3	32.1	36.1	32.5	41.6	40.3	45.0	34.8	32.6
Weight of arch, per square foot, pounds	42.6	42.3	47.4	44	57.5	53.[illegible]	57.4	47.0	42.7
Weight of blocks, total, pounds	469.25	481.5	531.5	493.25	624	620.75	769.5	550	514
Weight of sand, pounds	86	78	83	88	116	102	110	96	82
Weight of cement, pounds	68	60	66	70	97	84	82	77	63
Weight of water, pounds	32	30	32	34	49	42	44	38	32
Total weight, pounds	655.25	649.5	712.5	685.25	886	848.75	1005.5	761	691
Total weight, less half water, pounds	639.25	634.5	696.5	668.25	861.5	827.75	983.5	742	675

Test No. 81. — This was a hard tile side-construction arch with 8 in. blocks, the effective height of the arch being 7 ins. It was laid in Portland cement with a leveling of about 5/16 in. of cement on top; the load was applied near the center on an area of 10 by 12 ins. (see Fig. 38). The tying was done by hook rods placed as shown. At 5,250 lbs. the first crack appeared, and the key opened about 1/16 in.; at 8,750 lbs. the crack opened wider, and cracks appeared at the left skewback, opening wide; at 10,000 lbs. the arch collapsed, and cracks appeared at the left skewback; there was a crushing in of the voussoir along its entire length under the right-hand edge of the block on which the load was applied.

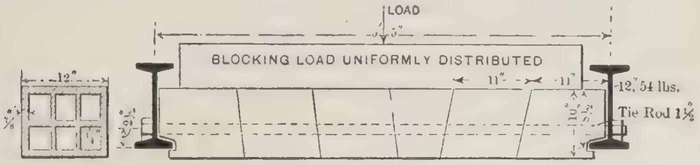


FIG. 33.

Test No. 82. — This was a side-construction hard tile arch, shown in Fig. 34. The loaded area was 7½ by 41 ins. The load was continuously applied; at 5,000 lbs. there was a slight opening of the skewback; at 5,700 lbs. there was a failure of the east skewback by shearing. Fig. 39 shows the nature of the failure.

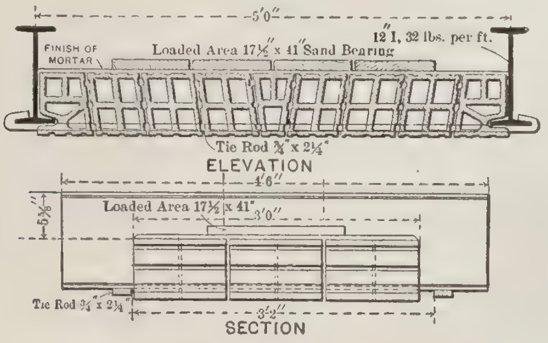


FIG. 34.

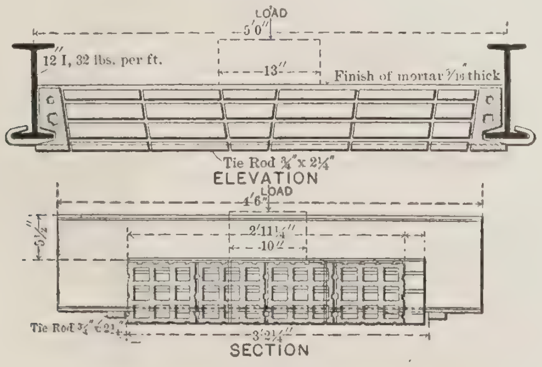


FIG. 35.

Test No. 83. This was of an arch of hard tile end construction, with porous terra-cotta solid skewbacks; the effective height of the arch was 5¾ ins., although the blocks were nominally 8 ins. There was 5/16 in. finish of mortar on the top, and the load was applied on an area of 10 by 13 ins., as shown in Fig. 35. At 5,000 lbs. there was a slight hair crack at the junction of the skewback block with the skewback I beam, and a slight crack at the right-hand side and bottom of the key block. There also appeared a slight hair crack in the mortar cover of the top of the arch. At 6,250 lbs. the crack on the right-hand side of the bottom key opened 3/32 in., and the top surfacing began to crack. At 7,500 lbs. it cracked in the middle and rose, and the crack in the key opened ⅛ in. At 8,750 lbs. the top cover bulged further, and the arch opened ⅜ in. at the bottom of the key. At 10,000 lbs. the top surfacing had bulged 1 in., and the plaster began dropping out (see Fig. 40). At the left-hand end of the arch, the joint between the skewback block and the end-construction block opened, and at 11,250 lbs., the maximum load, the arch practically failed, the top cover bulging and cracks radiating out in it from each corner of the block on which the pressure was applied, at an angle of about 45 degs. with lines drawn perpendicular and parallel to the skewback beams. The pumping was renewed, when the bottom of the skew dropped off at the left-hand end, being sheared through. Then the two east skews, or the parts of the skews which protected the bottom flange of the I, dropped off, and a spall appeared in the bottom of the first voussoir away from the skew, at the left-hand end. At the right-hand end the flange protection dropped off, and cracks appeared running to the right and left from the upper half of the lower hole in the skewback block.

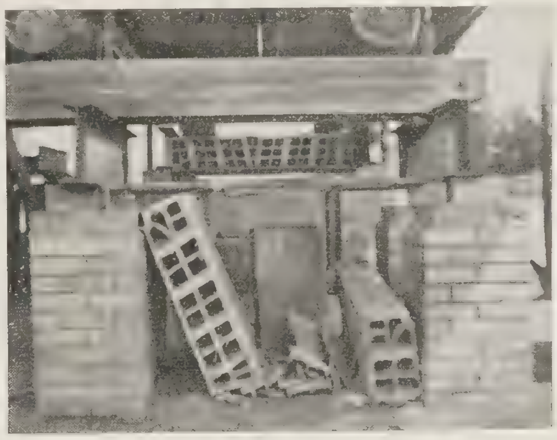


FIG. 38.

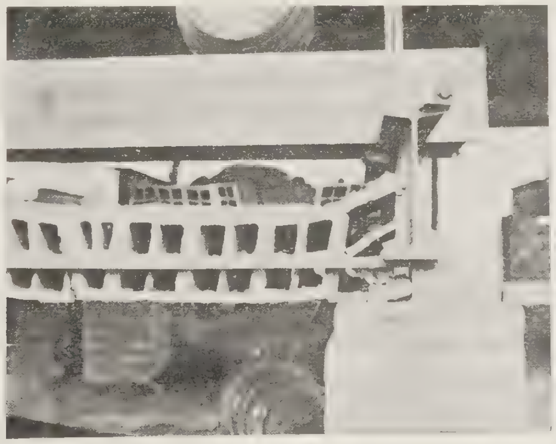


FIG. 39.

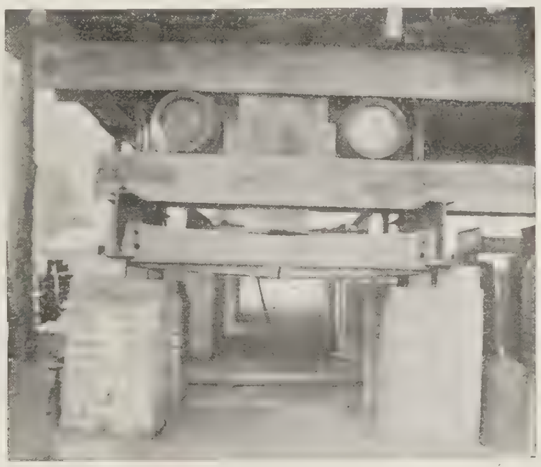


FIG. 40.

(*To be continued.*)

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI.

(*Continued.*)

THE CHEMISTRY OF CEMENTS.

It is as quick to combine with silica as is lime. During calcination it parts with its carbon dioxide at a lower heat than is required for the expulsion of that acid from the lime, and becoming caustic in advance of the lime, is the first to attack the silica, freeing the latter from its combination with alumina, thus rendering the silica as free silicic acid, and if the high heat is continued; a reaction takes place, and chemical combination ensues between the acid and the three bases, in accordance with their atomic weights, as fully illustrated in the table of combining ratios.

A simple illustration of the fact that the reaction follows the separation of the alumina from the silica, and a chemical combination with the acid and all the bases takes place, is afforded by the following experiment: —

First. Take a piece of magnesian cement rock and from it secure two pieces weighing one or two pounds each, and after they have been gradually dried out, to prevent what is known by kiln men as "popping," which is caused by a bursting into small pieces through the sudden conversion of the moisture contained in the rock into steam, place both these pieces in a smith's forge and rapidly drive them up to nearly a white heat, then suddenly withdraw one of the pieces from the forge, and as quickly as possible crush it to powder while hot.

Second. Continue the heat with the other piece for half an hour or so, then stop the blower and allow the piece to cool gradually, keeping it covered in the forge until it is cold, then crush to powder.

Third. Keep the two samples separate and wet them into balls, patties, or briquettes, and note the difference in the action of the two. The first will heat, expand, and check, and if placed under water will become of a mud-like consistency, and if in air, it will crumble into dust-like ashes; while the second sample will not heat, will not expand or check, and after an hour in air will sustain submersion and become hard.

The first sample was withdrawn from the heat after the expulsion of the carbon dioxide, and before it had time for the reaction and formation of silicates, and the constituents were in a free condition, as shown by the heat and expansion when hydrated, while the second sample was accorded the necessary time for such reaction and chemical combination; thus proving the truth of our assertion, that whenever present with silica and lime, and under high and continued heat, both magnesia and alumina combine with the silicic acid in precisely the same manner as lime combines, in certain fixed proportions, according to the law of atomic weights.

A table of the atomic weights of such elements as are found in hydraulic cements is herewith given. The numbers indicate the relative weights of the atoms constituting the elements.

ELEMENTS.	SYMBOL.	ATOMIC WEIGHT.
Alumina	Al.	27.
Calcium	Ca.	39.9
Carbon	C.	11.97
Hydrogen	H.	1.
Iron	Fe.	55.9
Magnesium	Mg.	23.9
Manganese	Mn.	54.8
Oxygen	O.	15.96
Kalium (Potassium)	K.	39.03
Sulphur	S.	31.98
Silicon	Si.	28.
Sodium (Natrium)	Na.	22.99

Although the system employed in calculating the percentages of the various chemical combinations which occur in hydraulic cements is familiar to many, yet a desire has been expressed that it be illustrated in a plain and practical manner, which may be readily understood by those who have little time to devote to such study, and for this reason a place is given to the following calculations.

SILICATE OF LIME.

Silica (SiO_2) is a chemical combination of silicon and oxygen in the proportion of one atom of silicon (Si) to two atoms of oxygen (O).

By reference to the table, it will be seen that the atomic weight of silicon is 28., and that of oxygen is 15.96. Two atoms of oxygen will therefore weigh 31.92.

Thus, $28. + 31.92 = 59.92 =$ silica. By dividing each number by 59.92 we get the percentage of each.

$$\left.\begin{array}{l} 28.00 \div 59.92 = \text{Silicon } 46.73 \\ 31.92 \div 59.92 = \text{Oxygen } 53.27 \end{array}\right\} = 100 \text{ Silica } (SiO_2).$$

Employing the same method with reference to lime (CaO) we find that the atomic weight of calcium is 39.90, which, being added to one oxygen $15.96 = 55.86 =$ lime.

$$\text{Therefore } \left.\begin{array}{l} 39.90 \div 55.86 = \text{Calcium } 71.43 \\ 15.96 \div 55.86 = \text{Oxygen } 28.57 \end{array}\right\} = 100 \text{ lime } (CaO).$$

Silicate of lime is formed by a combination of silica and lime in the proportion of one part of the former to two parts of the latter, the combining numbers of which are as already given.

$$\left.\begin{array}{l} 1 \text{ Silica} = 59.92 \\ 2 \text{ Lime } (55.86 \times 2)\ 111.72 \end{array}\right\} = 171.64.$$

$$\left.\begin{array}{l} 59.92 \div 171.64 = \text{Silica } 34.91 \\ 111.72 \div 171.64 = \text{Lime } 65.09 \end{array}\right\} = 100 \text{ Silicate of Lime } (2\ CaO, SiO_2).$$

CARBONIC ACID.

$$\left.\begin{array}{l} \text{Carbon (C) } 11.97 \\ 2 \text{ Oxygen (O) } 31.92 \end{array}\right\} = 43.89.$$

$$\left.\begin{array}{l} \text{Carbon } 11.97 \div 43.89 = \text{Carbon } 27.27 \\ \text{Oxygen } 31.92 \div 43.89 = \text{Oxygen } 72.73 \end{array}\right\} = 100 \text{ Carbonic Acid } (CO_2).$$

CARBONATE OF LIME.

$$\left.\begin{array}{l} \text{Lime } 55.86 \\ \text{Carbonic Acid } 43.89 \end{array}\right\} = 99.75.$$

$$\left.\begin{array}{l} 55.86 \div 99.75 = \text{Lime } 56 \\ 43.89 \div 99.75 = \text{Carbonic Acid } 44 \end{array}\right\} = 100 \text{ Carbonate of Lime } (CaO, CO_2).$$

SILICATE OF MAGNESIA.

$$\left.\begin{array}{l} \text{Magnesium } 23.9 \\ \text{Oxygen } 15.96 \end{array}\right\} = 39.86 \text{ Magnesia } (MgO).$$

$$\left.\begin{array}{l} 1 \text{ Silica } 59.96 \\ 2 \text{ Magnesia } (39.86 \times 2)\ 79.72 \end{array}\right\} = 139.68$$

$$\left.\begin{array}{l} 59.96 \div 139.68 = \text{Silica } 42.92 \\ 79.72 \div 139.68 = \text{Magnesia } 57.08 \end{array}\right\} = \text{Silicate of Magnesia } (2MgO. SiO_2).$$

Among the manufacturers of artificial cements during the past twenty years or so there has been a constantly growing ambition to increase the number of pounds of tensile strain their cement will sustain, expecting thereby to improve the quality of their respective brands.

Goaded on by the universal preference for the brands showing the highest tests, they are striving by every means at their command to attain still higher results.

Many experiments were tried by adding foreign substances in varying percentages, among which may be mentioned sulphate of lime, which still obtains among nearly all the producers of Portland cement.

It is not denied by the manufacturers that by its use much higher short time tests are possible, and they justify its use by their assurance to the public that they do not use too much of it, thereby admitting its harmful character, which is so great that the German society of Portland cement manufacturers publicly advertise that the members of that society are not permitted to use more than three per cent. of this material in their cements.

No one will claim that a mixture of sulphate of lime in a cement is beneficial; on the contrary, it is well known to be harmful, and that a cement is better without it, even though it may not test so high by a few pounds in one-day or seven-day tests.

Its use simply illustrates the unreasoning desire to reach a little higher mark in testing.

Several years ago it was discovered that an addition of lime beyond its equivalent of silica would permit of a higher heat in calcination, which in turn gave a cement the quality of sustaining higher short time tests; and the manufacturers were not slow in availing themselves of this apparent advantage.

And thus the proportion of lime has been gradually increased until to-day there will be found in all brands of Portland cement, as has already been stated, from 2.7 to to 3.2 of lime to 1 of silica.

Although it was learned that by increasing the proportion of lime higher short time testing results followed, yet it became evident that such a cement must necessarily contain a large proportion of free lime, which was not considered a desirable result; and to overcome this unpleasant difficulty, some of the leading authorities asserted that the excess of lime was taken up and combined with the alumina, forming aluminate of lime, as shown in the tables quoted from Professor De Smedt, who, it will be observed, gives the combining proportions as silica 34.88 and lime 65.12, the ratio being silica 1, lime 1.86, and the ratio of alumina 1 and lime 2, to form aluminate of lime.

But as the percentage of lime has been gradually increased, it has been found necessary to establish a new ratio as between the silica and lime, the German authorities taking the lead in this new departure; and it is now gravely asserted that 1 molecule of silica combines with 3 molecules of lime, making the ratio 1 of the former to 2.79 of the latter.

As the modern Portland contains from 2.80 to 3.25 of lime to 1 of silica, the lime, which is in excess of the new ratio, is conveniently taken up by the alumina, forming aluminate of lime.

Thus for the present, at least, the authorities on Portland cement seem to have the ratio satisfactorily adjusted.

It is probable, however, that some way would be found to show conclusively that 1 part of silica combined with 4 or more parts of lime, should some genius discover a way to produce higher testing results by such a manipulation of proportions.

To show the tendency toward increasing the proportion of lime, which is done solely for the purpose of gaining higher short time tests, it is only necessary to take as an illustration the analysis of one of the foremost brands of English Portland cements; a cement which, twenty years or so ago, commanded the largest sale, and the highest price of any cement in the American markets.

The analysis was carefully conducted by the painstaking and conscientious chemist, Prof. E. T. Cox, while he was State geologist of Indiana.

The constituent parts of this cement, after discarding the non-essentials, will be found in column No. 1 of the following table, and the percentage of silicates appears in the succeeding columns.

No.	1	2	3	4	5	6	7
Silica	30.89 —	1.65 =	29.24 —	17.44 =	11.80 —	11.57 =	00.23
Alumina	10.82 —	0.94 =	9.88 —	9.88 =	0.00 —	0.00 =	0.00
Lime	57.19 —	3.08 =	54.11 —	32.52 =	21.59 —	21.59 =	00.00
Magnesia	1.10 —	1.10 =	0.00 —	0.00 =	0.00 —	0.00 =	0.00
Totals	100.00	6.77		59.84		33.16	00.23

Silicate of lime, magnesia, and alumina	6.77	
Silicate of lime and alumina	59.84	
Silicate of lime	33.16	
Total silicates		99.77
Uncombined silica		00.23
Total		100.00

(*To be continued.*)

FROM OTHER COLUMNS.

WHAT CAN BE DONE WITH A BARREL OF PORTLAND CEMENT.

WHEN USED WITH 1 BARREL OF SAND.

68 sq. ft. 1 in. thick.
102 sq. ft. ¾ in. thick.
136 sq. ft. ½ in. thick.

WHEN USED WITH 2 BARRELS OF SAND.

99 sq. ft. 1 in. thick.
148½ sq. ft. ¾ in. thick.
198 sq. ft. ¾ in. thick.

WHEN USED WITH 3 BARRELS OF SAND.

130 sq. ft. 1 in. thick.
195 sq. ft. ¾ in. thick.
260 sq. ft. ¾ in. thick.

— *Paving and Municipal Engineering.*

THE term "hydraulic," as applied to mortars and cements, means that such masses continue to harden under water after they have set. Their "setting" may require half an hour, several hours, or even a whole day, according to the nature of the compositions, but the hardening under water is apt to continue with all of them for years. Hydraulic mortars are mixtures, the essential constituents of which are lime, siliceous substances on which dissolving lime can react chemically, and water; and hydraulic cements are either natural or artificial compounds of siliceous substances and lime, which have been burned to the sintering point, and which are used without admixture of lime. The setting of hydraulic mortars is due to incipient reactions that take place between dissolving lime and soluble siliceous matter. Though the quantity of the new matter that is formed by such reactions is at first of rather infinitesimal proportions, it is capable of bonding the mass in which it forms. When such masses are allowed to dry completely, then they do not become much harder — and sometimes not as hard — as ordinary air mortars. Hence it is said that hydraulic mortars *set* rather indifferently. Hydraulic cements set very energetically, because their particles — or at least a great portion of them — *hydrate* when they come in contact with water. Their setting may — in that respect — be compared with that of plaster-of-Paris, but with just this difference: the particles of a mass of plaster-of-Paris all hydrate inside of a few minutes and increase in volume while they are hydrating; hence, their cohesive attraction becomes partly neutralized by their expansion; the cement particles, on the other hand, do not expand sensibly, and hydrate gradually, not completely at once nor all at the same time; hence, it may be said that their mass solidifies actually on account of the cohesive attraction of its hydrating particles. That this action continues, long after the mass has set, is evident from the fact that hydraulic cements take up over three times as much water, within three days after having set, than they combine with while they are setting. — *A. D. Elbers, in Engineering and Mining Journal.*

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

FORMAL ESTIMATES.

PROBABLY the most important step in building operations affecting the relation between the architect and contractor is that of obtaining formal estimates or bids for proposed work. Most of the responsibility at this point rests with the architect, and if the drawings and specifications he presents for figuring are clear and complete, the execution of the work after the contract has been awarded should, so far as he is concerned, present comparatively few difficulties. And it is safe to say, on the other hand, that many of the annoyances and misunderstandings for which the architect can be held responsible, which so often arise in building operation, can be traced back, directly or indirectly, to the time when the work was figured. The obligations of the architect at this point are clearly set forth in recommendations of the Boston Society of Architects in regard to the practise in obtaining estimates from contractors. And they are here given in full.

1. Drawings, when offered for final or competitive estimates, should be sufficient in number and character to represent the proposed works clearly; should be at a scale of not less than one eighth of an inch to the foot, and be rendered in ink or some permanent process.

2. Proper details should be furnished for work that is not otherwise sufficiently described for estimate.

3. Specifications should be in ink. They should be definite where not sufficiently defined and explained by drawings, and every distinctive class of work to be included in contract should be mentioned and placed under its appropriate heading.

4. Contractors should be notified, at time of estimate, if they are to be restricted in the employment of their sub-contractors.

5. Sub-bids received by architects should be held as confidential communications until all the estimates in a given class of work have been submitted.

The principal contractor should add to his bids all these sub-estimates while in the architect's office, and should sign a tender in which the names of all of these above-mentioned sub-contractors should be enumerated.

6. A sub-contractor should not (without his free consent) be placed under a general contractor, and no general contractor should be compelled to accept (without his free consent) the estimate of any sub-contractor.

7. Should a contractor decline to assume in his contract the estimate for any work not included in his original estimate, he should not thereby be denied the contract upon the portions of the work covered by his original estimate.

8. Estimates should not be binding more than thirty days after they are received.

9. Unless previous notification has been given to the contrary in the specification or otherwise, the lowest invited bidder is entitled to the contract. If radical changes are made, the whole competition should be reopened.

10. After bids have been received, and before the award, bidders should not be allowed to amend their estimates.

It is important for the architect, while the estimates are being made, to scrupulously guard the interests of the different parties concerned, particularly those of the sub-contractors, whose figures, from force of circumstances, must be handled more or less openly, and are, consequently, more from thoughtlessness than any other reason, often left where they can be seen by competitors in the same class. Some contractors have a way after the bids have been opened but before the work has been awarded, particularly if they have cause to think their bid is not the lowest, of submitting amended and lower estimates, based upon the assumption that they have found a mistake in figures or discovered some way in which a considerable saving can be made. Such proposals should, under no consideration, be entertained, and any architect who considers them is sure to forfeit the respect of the bidders. There has been a practise among some architects of calling for a large number of alternative estimates upon a given piece of work. While this is justifiable under certain conditions, it always lays the architect open to the charge, whether well founded or not, that it is done to allow for trading or giving the work to a certain favored contractor, and in the best practise the number of alternative estimates are very limited and confined to important items. Ordinary alternatives as well as minor changes should be adjusted with the lowest bidder, and if his figures appear to be unfair, the matter can be settled by arbitration.

It is well here to call attention to the fact that much of the difficulty in properly adjusting the value of extra work or work omitted comes from the fact that contractors often figure work at cost, or with only a narrow margin of profit, and then depend for their profit on what can be made on "extras." This practise always produces most disagreeable results, and usually a running fight between the architect and contractor. There is no surer way to put an end to this undesirable state of things than for the architect to have the plans so well matured and the specifications so comprehensive at the time the work is figured that the contractor will be obliged to make his profit in a legitimate way or not at all.

It is well for the architect to bear in mind, when he offers plans and specifications for estimating, they will be looked at by a new set of men, and from a different point of view; he should, therefore, be willing to answer any fair questions which may be asked, and to furnish such information as may be necessary to explain his meaning. All the different parties who are figuring the work should be given the benefit of all such knowledge as affects their interest, and the best way to accomplish this is to keep a memorandum of the various points as they are raised, and before the estimates are handed in to send it to all the competitors. There is no better way in which the architect can win the respect of those who do work under his direction than to be absolutely fair and above board in handling estimates; and if he pursues such a course he will always find, if he deals with those whose intentions are right, that in a great measure so far as he trusts others he will be trusted himself.

(*To be continued.*)

MANTELS.

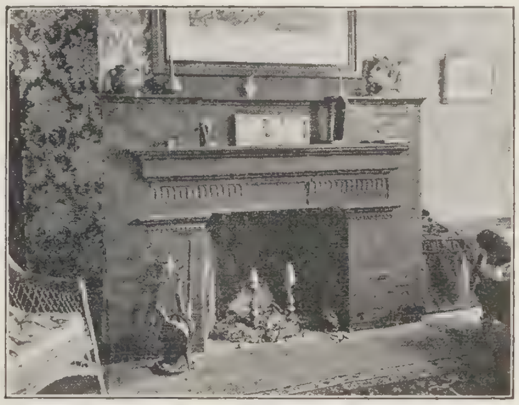
THE building of masonry mantels, whether of bricks, terra-cotta, or stone, has become almost an art by itself. The days when any bricklayer who could build a chimney was considered competent to build the fireplace are past.

Material has been multiplied and elaborated; bricks have been molded and carved; richly modeled terra-cotta and faience, carved stone and marble, are now extensively employed to make the mantel and fireplace an object of interest and of art, and a specially trained mason must be called upon to build it.

Unless specially trained to the delicate trade of building mantels, he will find his task quite a difficult one, even though he is a very efficient workman on outside brickwork. Sometimes a mason, however, is required to lay up mantels without the preliminary apprenticeship on mantel work. His experience on front brick-laying will of course be of immense assistance to him. The necessity of carefully laying out his work before building the mantel will be new to him.

The positive need of following a drawing exactly and intelligently will, perhaps, be the most difficult for him to realize. Among our workmen there is a feeling sometimes shown that they deem themselves competent to do anything that is at all related to their trade. It is no discredit to a mason to state frankly that he has had little experience in this kind of work, but will do his best; such an admission will show his honesty, and if he display intelligence and care, he will find that he will receive patient assistance, and if he does not understand a drawing perfectly, he should have it explained to him. He will not only confer a favor on the architect, but will also advance himself in his new vocation, and, perhaps, save some expense and irritation.

It is dangerous and unsatisfactory when the unexperienced and thoughtless workman undertakes a delicate piece of work without appreciation of the needed carefulness, and with a feeling that he can bluff it through. It sometimes makes no end of trouble, especially in mantel work, where a botched job looks so evidently bad, and the ornamental parts, perhaps, cannot be replaced without long delays. The workman must respect his work, and feel that it is worthy of his best thought and most careful handling. The feeling with us that the first and all-important consideration is to get through with a piece of work as quickly as possible, get it finished and out of the way; the feeling of being hurried is injurious to the result unless a man is thoroughly experienced in his special line,—and, if so, he will probably be able to turn work off quickly. This constant pushing the workman must abide as a necessary evil; these are hurrying days and things must be done quickly. But the workman must bear in mind, also, that the real issue and the one most vital to himself and to all others concerned is that the work shall be done right and well. Haste will certainly not count to his credit if, when finished, his work is found to have been poorly done or mistakes made. Let each man be a law to himself, let his precept be, "Whatever I do shall be well done." This will give him a record, and with this a foundation principle, speed will come in good time, and the workman will be dubbed reliable and sure, and will in the rush of life naturally rise above his fellows.



BY PERMISSION OF THE PHILADELPHIA AND BOSTON FACE BRICK COMPANY.

Most men are desirous of improving their conditions in life, and the learning of a special line in a trade is one of the methods of improvement. There are really very few masons in the country who are qualified to lay up an elaborate brick mantel; and these are rapidly coming into use. Some are very ornate in design, requiring considerable skill to build, even after careful drawings. It really is a special trade, requiring very intelligent workmanship and careful calculation.

The architect finds the heedlessness of the workman one of his most trying conditions in erecting a building. A first-class builder will employ only competent workmen, and the majority, by taking an interest and pride in the work can be competent. It is this quality which causes a man to excel in any branch he may undertake in life. Some have it naturally, and others must constantly hold themselves up to a standard by vigilant watchfulness of self, if they wish to rise above the level of a laborer's station.

After a mason has become proficient in laying up a highly finished pressed brick front with one-eighth inch joints and carefully ground flat arches, he has had a good apprenticeship as an introduction to mantel work. Here he will find many complications arise unknown to external architecture, conditions which require his best judgment. He must know when he can settle a questionable point himself, and when it is wiser to appeal to a higher authority. In many cases he must be the final tribunal himself, and must wrestle alone with his drawing and his bricks. This element of judgment is a very important factor in mantel work, and as there is no rule of service to the mason, it must be inborn or cultivated by constant exercise and in all humility. There is one admonition, however, which the mason would do well to heed. The drawing for the mantel and fireplace will probably be quite right, and his first duty is to study it carefully and to follow it closely,—exactly, unless he discovers that its carrying out is impracticable. He must never tamper with a design with the view of improving it. This is a very delicate point, and the mason would do well to suppress his afflicted sensibility for art and follow the design precisely as indicated in the drawing. Suggestions of this nature, although given with best intentions, are seldom well received.

Before laying up any part of the mantel, the mason should place on the floor, in the relative position they will occupy in the mantel, all of the ornamental parts, and ascertain if all are on hand, and all are in a whole condition. This will also assist him in a translation of the drawing, and he may discover any mistake and be better able to rectify it before he progresses too far with his mantel.

Certain brick mantel concerns are careful to make a mantel fit the place for which it is intended and have all the ornaments space out correctly, and with such the mason will have no trouble. There are, unfortunately, other mantel firms who are not so exact, trusting to the mason to cut the ornaments and fit many parts of the mantel in place. This, of course, is unsatisfactory and will bring brick mantels into discredit. If the mason would complain of this state of things, mantel building would be much advanced, and the backward companies would soon be compelled to follow the leaders, and carefully fit their work before it leaves the yard.

Some knowledge of ornament is necessary to the mantel mason. He should know when his ornament is continuous and complete. He must know how to join the egg and dart, or the pearl and reel, to have them correct and architectural; and as he can hardly be expected to know this by instinct, he should make himself familiar with the usual forms employed in architectural ornamentation. The more intelligent and apt he becomes in the knowledge of architectural forms, the more able assistant will he be in putting into material existence a cherished design,—and the mason should believe that every design is a cherished one, no matter how simple or how bad it may seem to him. He should know all the arts of bringing the good points out of his material, for it may even be in his power to save a mediocre design by exquisite workmanship.

The color of the mortar which will affect the appearance of his work may be left to him. A few suggestions in the color of mortar may not be out of place here.

Lime mortar appears unpleasantly white when used with a dark-colored brick. It is desirable to add a little cement, which not only strengthens the mortar, but also grays it slightly. If a white or creamy brick is used, the pure lime mortar would lighten the general tone of the mantel, but is rather trying to the delicate tone of the light bricks; and if they run unevenly in color, it is better to add the cement, as it will give the work more character. A little red coloring in the lime mortar will give a pinkish flush over the work.

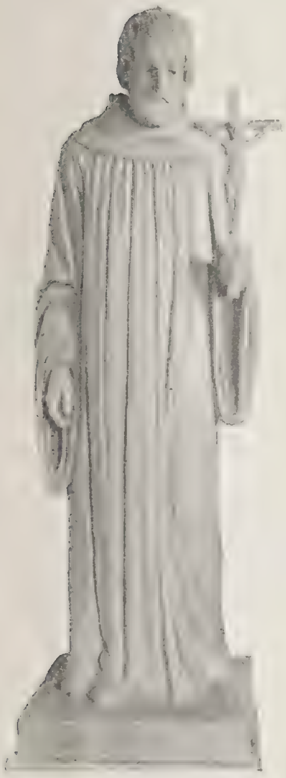
Faience and tile mantels should be laid with the finest joints possible, and pointed with Keene's cement, to expose a hard, white surface least susceptible to soil. The coloring of the mantel joints influences the tone of the mantel greatly, and may assist to harmonize the brickwork with the decorative scheme of the work with which it is placed.

A. Mason.

This department is always open to our subscribers for the discussion of any subject that may be of interest to the mason.

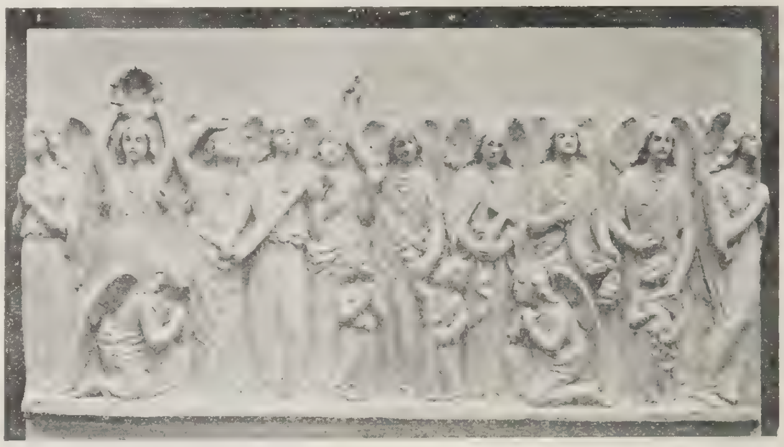
Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.



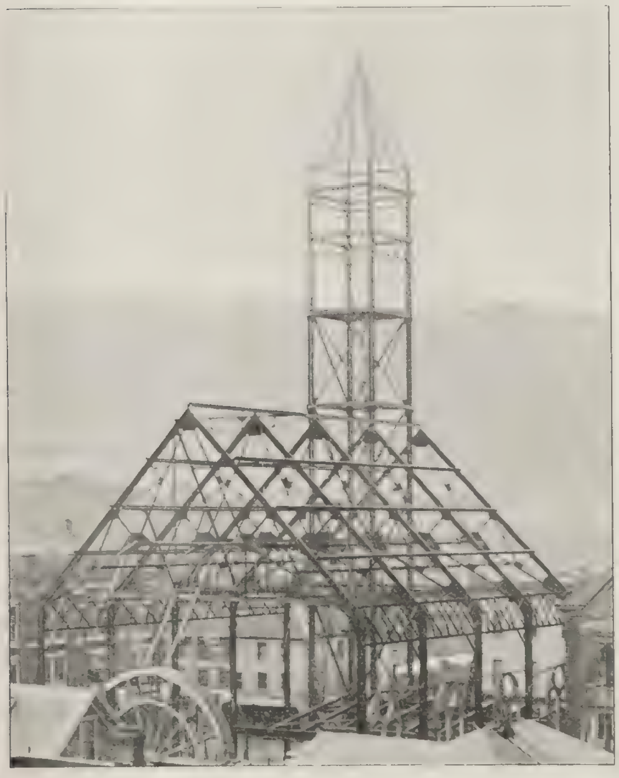
TERRA-COTTA FIGURE IN ST. JOHN'S CHURCH.

WE publish with this issue a number of cuts, illustrating the construction and the details of the Church of St. Johns, at Johnstown, Penn., and we feel that they warrant a little more than a passing notice, as affording an example of a church edifice, constructed almost entirely of brick, terra-cotta, and tile. In fact, these materials are used exclusively for all the exterior, with the single exception of the front doors. The construction of the church is entirely on the skeleton system, another innovation on the ordinary plan. The framework starts from the foundations with heavy Z-bar columns, and is carried across the church with steel truss construction, and up into the towers with lattice tracings. Although the skeleton is of steel, the only difference which it makes in the construction is in the thickness of walls and consequent cost. The outer walls are from 18 to 24 ins. thick. The smaller tower is roofed with a very clever adaptation of the form of 10 in. tile usually adopted for floor construction, the tile in this case of course being made to order, with a specially shaped shell pattern on the outside. The main tower is capped by a pyramidal roof covered with terra-cotta tiles. Constructively this design offers a great deal of interest. It is an honest attempt to use a consistent brick and terra-cotta treatment throughout, and, as far as we can recollect at this moment, is the only building of its kind in existence. The floor construction is entirely of steel and brick, terra-cotta, or concrete, being practically fire-proof throughout. All of the exterior details are executed in terra-cotta, including the frieze of figures around the top of the larger tower, and the crowning statues of the gables, which are modeled and burnt in a single piece. The cost of the completed structure was about $80,000. The terra-cotta was executed by the Standard Terra-Cotta Company, of Perth Amboy, N. J., from the designs of Beezer Bros., Altoona, Pa., the architects of the church.

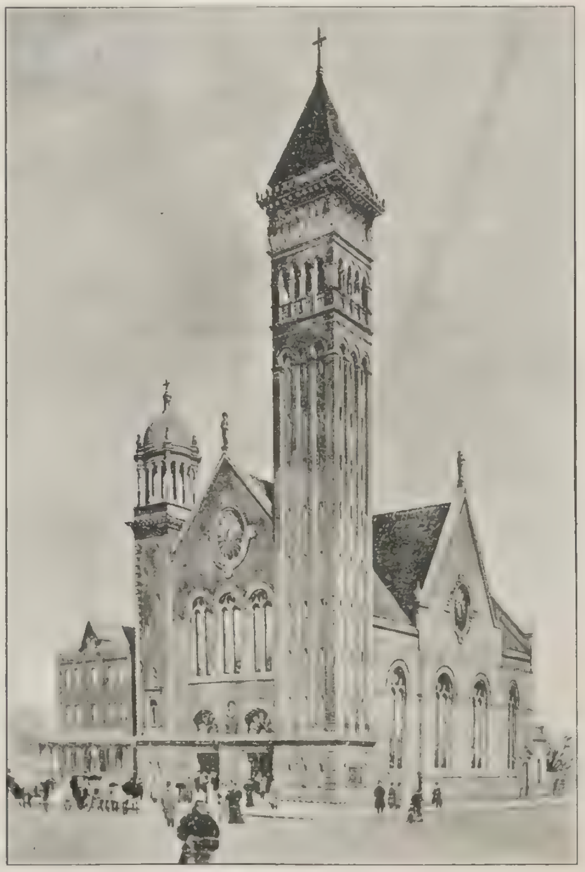


TERRA-COTTA FRIEZE, MAIN TOWER, ST. JOHN'S CHURCH.

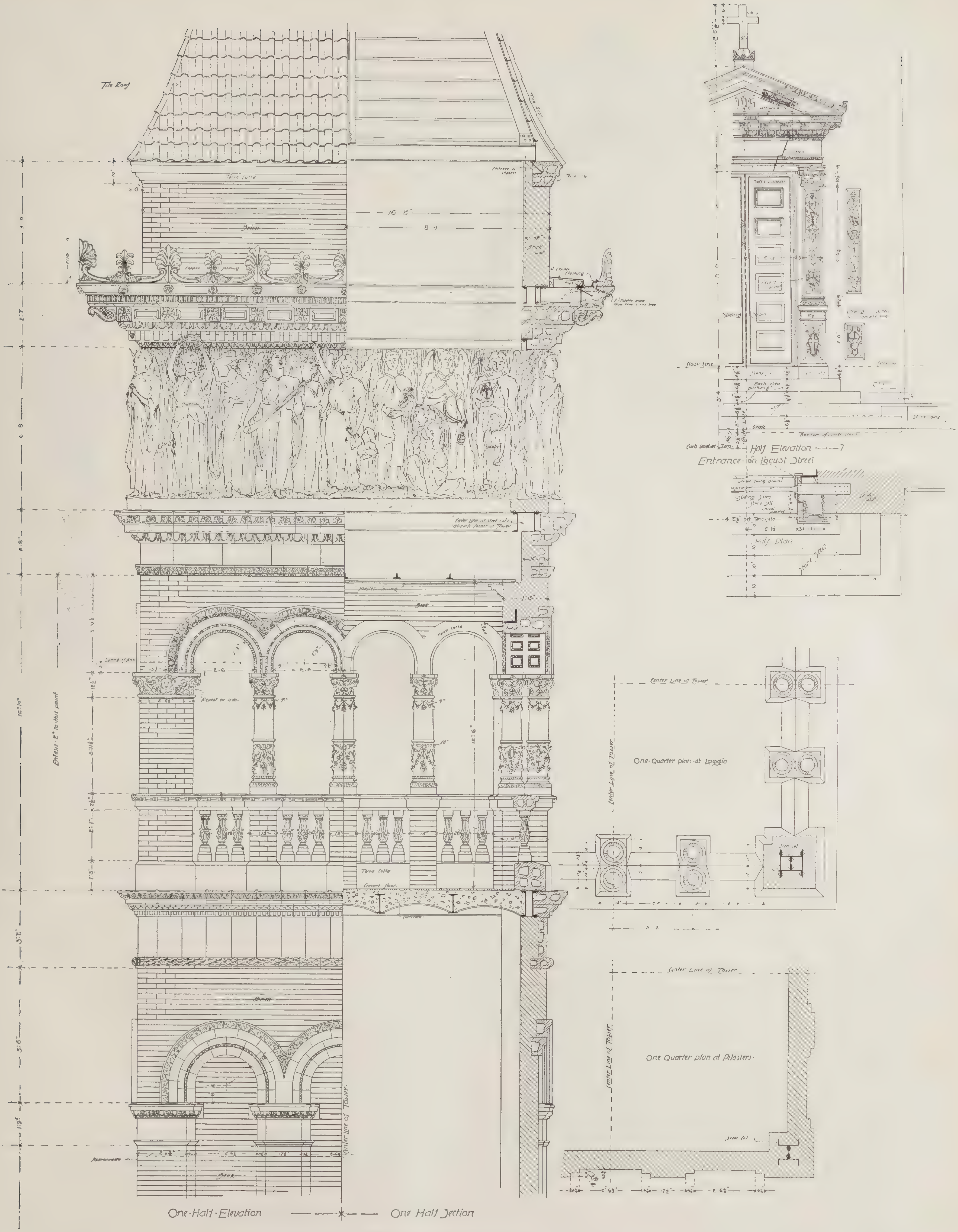
Scale drawings of the tower details are shown on pages 89 and 90.



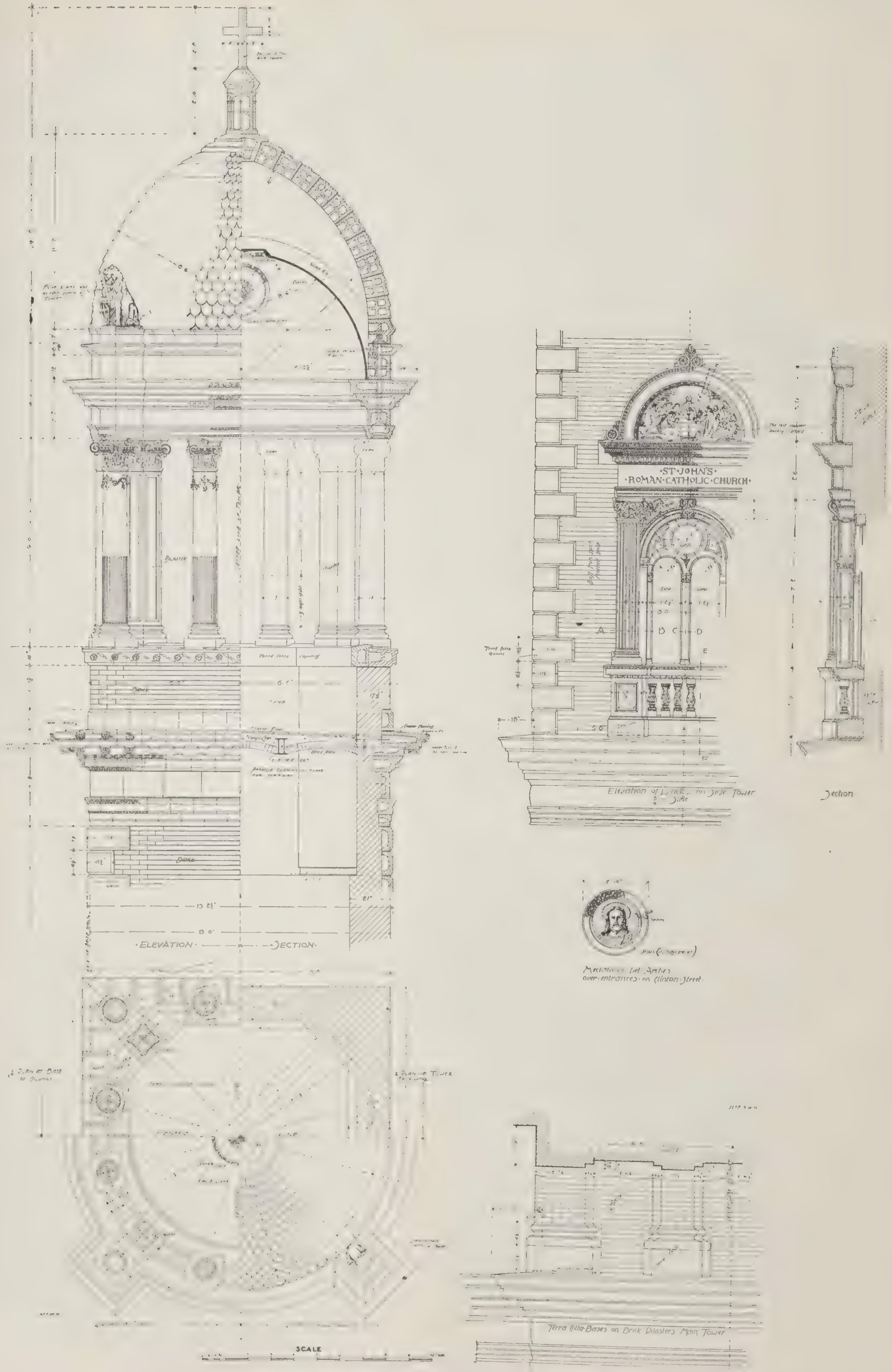
SKELETON STEEL FRAME, ST. JOHN'S CHURCH, JOHNSTOWN, PA.



ST. JOHN'S CHURCH, JOHNSTOWN, PA.,
Beezer Bros., Architect.



DETAILS OF MAIN TOWER, ST. JOHN'S CHURCH, JOHNSTOWN, PA. BEEZER BROS., ARCHITECTS, ALTOONA, PA.


ELEVATION
SECTION
ST. JOHN'S ROMAN CATHOLIC CHURCH
Elevation of Entrance on Side Tower
Section
Medallion over Arches over entrances on Clinton Street
Terra Cotta Bases on Brick Pilasters Main Tower
SCALE

DETAILS OF SIDE TOWER, ST. JOHN'S CHURCH, JOHNSTOWN, PA. BEEZER BROS., ARCHITECTS, ALTOONA, PA.

NEW YORK.— The most important piece of news in the discussion of buildings in New York is that the legislature has failed to pass the bill to limit the height of business buildings. It is said by some of the writers upon the daily papers that this is a final settlement; that, before another session can occur and a new bill be presented, so many tall business buildings will have been begun, that to restrict others from building as high as they please would be a gross injustice.

The question of justice or injustice is not what determines the acts of legislators. However, the bill which has recently been defeated must have had powerful interests behind it, so powerful that it is, indeed, improbable that any weightier backing for a new bill can easily be found.

Certainly owners seem disposed to avail themselves of their now undisputed liberty to build Babel towers *usque ad cœlum.* Although architects share the general dulness of business, yet there is enough doing here and there to raise cages of steel, covered, wholly or partly, with their brick casings all along the line of Broadway and upon other main thoroughfares.

In spite of the serious objections that may be fairly urged against such structures, the one preponderant reason for their existence is absurd and impossible size, to which the modern aggregation called a city is fast extending.

The time was, and not so very long ago either, when a city was a circumscribed locality, with clear boundaries and sharp definition between it and the outlying country, even after the days of walls had passed. Paris of the Revolution had but half a million people, and until recently only London could have been described as a *province couvert de maisons.* But now every city that aspires to be called great is of unheard-of dimensions. The really built up part of New York and the adjacent Brooklyn is ten miles long and seven or eight broad. It is easily possible in the city of New York proper, on Manhattan Island, to travel fifteen or twenty miles daily, simply running about doing necessary business errands.

There is a limit to this sort of thing. If men live in cities for the convenience and economy of being near together, the reason for the existence of cities vanishes if their inhabitants are not near together.

That is why the high building has taken the hold that it has. For my part, miserable and moribund as the whole system seems to me, I should like to see it pushed to its logical extreme and see what would come of it before commercialism perishes, as one pushes their mathematical formulas to an impossibility of a zero or infinity before leaving the investigation. I should like to see the restriction on the height of dwelling-houses which does exist finally removed, and try whether immensely high apartment houses could not be made as comparatively comfortable and luxurious as office buildings have been proved to be. It is not an entirely delightful thing sitting, as I am sitting, in a seventh-story room, with a fine view of the seventh story of another just such building. It would be much better worth one's while to live if life could be in a distant country studio, as was the wise Richardson's, with leaves, and blossoms, and sky. But if we must join ourselves into closest contact, driven by self-destructive social forces, let us make our crowding as comfortable as we can, and abjure the trolley in favor of the elevator.

CHICAGO. — The recent exciting Republican State Convention, held at Springfield, Ill., was incidentally interesting from the fact that it occurred in the " Dome Building," which is the beautiful glass dome, designed by Jenney & Mundie, as the chief feature of the Horticultural Building at the World's Fair. After the fair the lofty shell of steel and glass was removed and erected at the State capital. With the addition of corner pavilions, forming a suitable architectural base, the exposition greenhouse was transformed into a permanent exposition building. Those who visited the World's Fair and saw the Horticultural Building, with its big dome, will be surprised to know that ten or twelve thousand people were gathered in convention under that same dome.

Another building of political association is the Chicago Coliseum. This is where the Democratic National Convention is to be held, and it is noteworthy, not only for that and for the catastrophe that occurred during its first construction last year, when the steel arch roof trusses collapsed into a complete wreck, but because just now there is being installed a heating plant of unusual general interest. The general arrangement can easily be imagined by thinking of the Manufactures Building at the World's Fair. The building is 700 ft. long and 300 ft. wide. The entire heating plant (except boilers which are outside at a distance) is located in one corner under the gallery. Fresh air is taken in through zigzag screens, and is then washed in a spray which requires 1,600 gallons of water per minute. Four 12 ft. Sturtevant fans, working in pairs, draw the air through steam coils, and force it through two great galvanized iron ducts, running each way under the galleries. These two trunk mains at the beginning are each 3 ft. deep by 20 ft. wide, and reduce gradually as various branches shoot a part of the warm air into space under the lofty roof, as well as under and above the gallery floor. There are no vents provided aside from cracks around windows and doors, and no air is reheated, but is taken constantly from out of doors. The contents of the building are 12,000,000 cu. ft., and the fans are capable of supplying that amount of fresh air every thirty minutes. There are no steam pipes or other radiation in the building except 60,000 sq. ft. in the corner where the fans are located. The contract for the installation of this heating plant, which was designed by the Chicago house of the Sturtevant Company, amounted to $36,000.

Those in a position to know assert that this is the dullest building season in Chicago for four years past. Building news have few important items in them. There is one, however, that *is* important. It is a great banking institution, only two stories high, to be located in the heart of the city. If present ideas materialize, this home for the Illinois Trust and Savings Bank will be a notable one.

Several well-known firms of architects in competition are now working on their respective solutions of the problem given them, which involves a large banking-room, covered with a dome. Surrounding this central banking-room are two stories of offices. The exterior is to be classic in treatment, and it is to be hoped that the result will be as much a matter of pride to Chicago as was the Art Building among the White City group.

A matter of lively discussion just now among architects is the " Code of Practise " just issued by the " Chicago Masons' and Builders' Association." Some of the salient points in this set of rules are as follows: —

Members are to buy materials from those dealers only who bind themselves to charge others ten per cent. higher than members of the association.

Demands made by the plans, and not referred to in the specifications, shall not be considered in the proposals.

Specifications shall state the day and hour when proposals are to be opened.

Bids must be opened and listed publicly, and the contract must be let to the lowest invited bidder.

Masons must not sub-let any of their work except for setting stone, tile, and terra-cotta.

Masons must not, in general, take any sub-contracts.

The association has a rule forbidding a member having partnership with a carpenter.

One rule in the " code " lays down the law that the particular form of contract adopted by the association is the only form of contract a member is allowed to execute for mason work.

The aim of the " code " is commendable, and many of the provisions are good. Doubtless, some of the most arbitrary rules had their reason in abuses indulged by dishonest architects and owners, whose moral sense is on a low plane, but the dictatorial tone and arbitrariness of some of the rules will, no doubt, be strongly resented.

PHILADELPHIA.—There is a movement on foot to prevent the continued erection of high buildings in and surrounding City Hall Square; at present it is in the shape of a petition to councils to condemn the properties to the northwest of the square, remove them and throw the block open to the public as a plaza; the scheme is in the hands of some of the most influential citizens, and is likely to receive favorable consideration; it is rumored that if this plan is approved by councils, there will be still another brought forth which will further improve the surroundings of the Hall.

The Board of City Trusts has abandoned the idea of tearing down the buildings covering the block between 11th and 12th Streets, and Chestnut and Girard Streets, and erecting thereon an immense building, as mentioned in our letter of last month; there will be a thirteen-story building erected upon the corner of 12th and Girard Streets, for which bids are now being asked: it will be of stone, brick, and terra-cotta, and be one of the most beautiful of the many office buildings in the city; the architect is Mr. Jas. H. Windrim.

Horticultural Hall, on South Broad Street, is fast nearing completion, and is having the finishing touches put upon the exterior; these are in the form of color decorations in the frieze and under the overhanging roof; from present appearances, they will greatly add to the beauty of the building, and should be a stimulus in the direction of more color treatment in our buildings; Messrs. Frank Miles Day & Bro., who are the architects, have, within the last few years, designed and executed several buildings in which similar color decorations have been prominent features; they are quite successful and universally liked.

A large Catholic Protectory is to be built this summer at Fatland, near Phœnixville, Penn., bids for which were recently asked in this city. It will be very large and extensive, embracing reservoir, refectories, workshops, etc.; the walls will all be faced with Pompeian bricks; Wilson Bros. are the architects.

ST. LOUIS.—The advance of spring offers no encouragement to the builder. What little hope some had of times being better has been dissipated, and every one has decided to make the best of it.

This city felt the panic of 1892 less, perhaps, than any other of the large cities, but we seem to have our turn now. There is, apparently, no good reason for this, as the new buildings and residences that have been finished lately do not stand vacant long.

Owing to the letting of some of the most important contracts to outside parties, the leading master builders have perfected an organization, hoping to advance the building interests in the city and protect themselves. It has a large membership, and its offices are filled by the most prominent builders of the city. Elegant quarters have been fitted up in the Turner Building, and were opened a few days ago with a banquet.

During the last few years almost the entire population of St. Louis have changed their residence, and the aristocratic neighborhoods of five or ten years ago have become business or manufacturing districts, the former occupants having gone into the suburbs, laid out and built beautiful parks, fine boulevards, and grand homes.

These places are of all grades, and so classified that even the most humble mechanic can find as desirable a home as the most aristocratic, although it may not be surrounded with all the elegance.

Large tracts, that five years ago were truck farms, dairies, etc., are now covered with residences, and the completion of the electric lines to Kirkwood, Clayton, and other suburban and county towns has opened up much new territory which will soon be covered with homes.

Doubtless there is no building in this city in which more interest is centered at present than the Auditorium, in which is to be held one of the great conventions next June, to place in nomination a candidate for President. By the time this appears in print it will be receiving the finishing touches.

It makes no great pretensions to architectural beauty, but the simple tale it tells is in marked contrast to some of our more pretentious buildings.

The Fagin Building, which is known at home and abroad for its startling architecture, and in the designing of which the architect sought originality, giving much time to special study and travel, is about to be thoroughly renovated. The massive granite front will be replaced by one of brick and terra-cotta, and with the extensive alterations in its interior it will be practically a new building.

The Brown Shoe Company is building a seven-story factory, to cost $100,000 when completed. Only four stories and basement will be built this year, but the additional stories will be added next. It is to be thoroughly fitted with the most modern machinery as well as construction. All machinery will be run by direct electricity. F. C. Bonsack is the architect.

Mr. Isaac Taylor is preparing plans for a building to replace the old landmark on the corner of 5th and Pine Streets.

The Holland Building, which, after many vicissitudes, was at last put on the market, seems to have come to a standstill again. The purpose of the projectors was to put up a building, arranged for physicians, providing for their special needs in the arrangement of rooms and other conveniences, including a library.

The design is in the German Renaissance, twelve stories, with high roof, in which is arranged the assembly room for society meetings, etc.

It is to be of steel construction, with exterior of brick and terra-cotta. Wheeler & McClure are the architects.

PITTSBURG.—The prospects for a good building season in this city are very flattering. Several of our architects have under way good structures, and others are busily engaged in preparing sketches. Pittsburg building tradesmen will not participate in the movement for the adoption of an eight-hour day this year. They are interested in getting wages advances first, and will leave the former for next year's consideration. The painters' strike has been settled by compromise, the wages agreed upon are $2.75 per day. The plasterers have also won their strike, which was for $3.00 per day.

The Carnegie Steel Company has been awarded the contract for the structural iron work for the Allegheny Post Office Building, with the exception of the dome, which will likely be of aluminum, furnished by a Chicago firm.

The plans of the Civic Club for the erection of free bath-houses are assuming tangible shape.

The sixth ward school board of Allegheny contemplates the erection of a new structure to cost $100,000.

The third ward is also considering the erection of one to cost $50,000.

Local architects have submitted plans for the Apollo school; to be of brick and stone.

The building committee of the Allegheny Theological Seminary has decided to erect a magnificent U. P. Seminary on the site of the present structure, to cost $125,000.

The Eighth U. P. Church of Allegheny propose to erect a new edifice on Perrysville Avenue, to be built of buff brick and stone, and to cost $35,000.

The Watson Memorial Church is having plans made for its new house of worship to be built at the entrance to Riverside Park.

Andrew Carnegie has purchased ground at Duquesne, upon which he will erect a library and gymnasium, to be of brick and stone, to cost $150,000.

The Westinghouse Library at Wilmerding, which was recently destroyed by fire, will be rebuilt at once, to cost $65,000.

The Syria Temple, Ancient Arabic Order Nobles of the Mystic Shrine, will erect a temple, corner Forbes and Stevenson Streets.

Architect Henry Mendall has prepared plans for an institution to be known as the Evangelical Lutheran Young People's Orphan Home, to be erected on Spring Hill, Allegheny, of brick, three stories, and to cost $20,000.

Architect E. E. Miller has prepared plans for a church for the U. P. Church of Sewickley.

Architect F. C. Sauer has prepared plans for a brick and stone church for the Immaculate R. C. Church, of Connellsville.

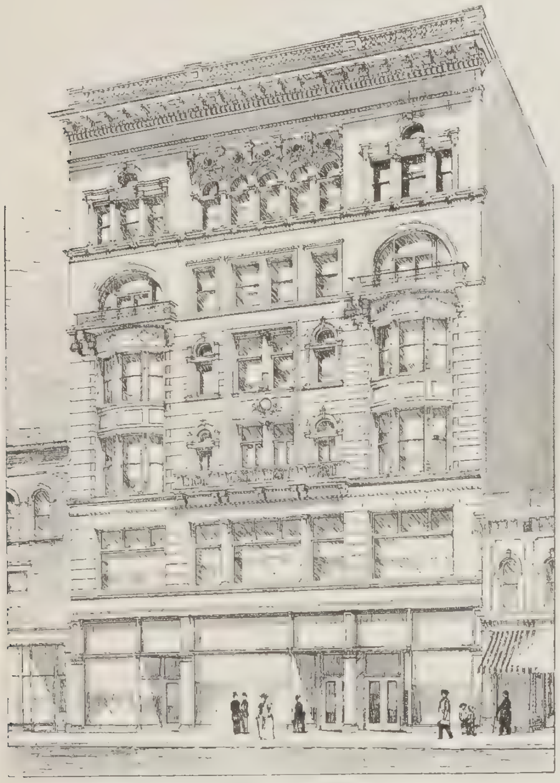
Architects E. J. Carlisle & Co. are receiving bids for the erection of the Hazelwood Presbyterian church; also for the school building at Duquesne.

Architect F. H. DeArment has prepared plans for a bank building for the First National Bank of Sistersville, West Va.

The First Presbyterian Church of Braddock have purchased a site on which they intend to erect a $30,000 church building.

DETROIT. — Architects Mortimer L. Smith & Son are letting contracts for the business block to be erected for the Eralsey Ferguson estate, illustration of which is presented herewith. It will front 63 ft. on Woodward Avenue, and extend 100 ft. down John Street. It will be of steel frame construction, with hollow tile arches for fire-proofing. The first and second stories will be of light-colored sandstone, and the remainder of the front brown pressed brick with terra-cotta trimmings. The roof will be of asphalt. The probable cost, $100,000. The work of construction will be commenced at once and pushed vigorously.

Architect Henry Engelbert, of this city, has plans for a church and convent for the Order of the Serites, to be built on Jackson Boulevard, Chicago. It will be 216 by 132 ft., constructed of stone, pressed brick, and marble. Estimate of cost, $120,000.



NEW BUILDING·FOR THE E.FERGUSON ESTATE.
WOODWARD AVE. MORTIMER L.SMITH & SON·ARCH'TS.

Architects Rogers & McFarlane have plans for an elegant colonial residence for Mrs. John Owen, to be erected on Jefferson Avenue, built of pressed brick, terra-cotta trimmings. Same architects have plans for a three-story block on Woodward Avenue, to be built of pressed brick with terra-cotta trimmings.

Architects Nettleton, Kahn & Trowbridge, who have just taken a handsome suite of offices in the new Union Trust Building, have plans for two four-story apartment houses, both to be built of pressed brick. Architects Baxter & Hill have plans for a terrace of eight three-story residences for John McDonald, to be located on southwest corner of Forest Avenue and St. Antoine Street, to be built of buff brick with sandstone trimmings.

Architects Malcomson & Higginbotham have plans for a brick and stone church for the Trumbull Avenue Presbyterian Society, to be built of brick and stone.

Architect Wm. S. Joy has plans for a $10,000 residence for Wm. A. King, Esq.; pressed brick and stone trimmings.

Architects Mason & Rice have plans for a pressed brick residence on Merrick Avenue, for Joseph M. Weiss.

MINNEAPOLIS. — Many of the schemes projected early in the year, and some a year or more ago, are now a certainty, active operations having begun in most instances. This has brought about a marked change for the better in building prospects for 1896, one of the results being that there are not enough mechanics available to do the suddenly increased volume of building that has been decided upon.

Work is being pushed on our immense new City Hall and Court House, and no doubt will be completed by the end of the year.

A chime of eleven bells has been placed in the tower of this building; the quality of their tones is giving entire satisfaction.

Among the more important items of improvements under way may be mentioned the following: seven-story factory building, 82 by 140 ft., corner First Avenue and 5th Street, C. B. Heffelfinger, architect, pressed brick front, mill construction, cost, $75,000. Three-story business building, 50 by 185 ft., at 3d Street and Fourth Avenue, for A. C. Godfrey, pressed brick fronts, cost, $20,000. Four-story cold storage warehouse for T. B. Walker, cost, $60,000. Orff & Joralemon were the successful architects in the competition for a county court house at Waseca, Minn. The building will be of pressed brick, and cost $45,000. Same architects have planned a school building for Stanley Hall School on Pleasant Avenue. The Board of Education has recommended another new school building in Hawthorne Park District, probable cost, $75,000. The Swedish Lutherans are taking steps towards the erection of a large hospital for their people. W. H. Hawes has plans for a Presbyterian church at Warsaw, Wis., to be built of pressed brick. E. P. Overmire has plans for a church for the Franklin Avenue M. E. Society, built of pressed brick with tile roof, cost, $50,000. W. C. Whitney has plans for a residence at Louisville, Ky., for S. A. Culbertson, pressed brick with terra-cotta trimmings and tile roof. Architect Jebson has plans for a residence for A. M. Smith on Nicollet Island, one half of which will be fire-proof, for library purposes.

The capitol commission has awarded the contract for foundations to Geo. J. Grant, of St. Paul, for $107,677; main walls are to be of granite, area walls and steps of local blue limestone, dome foundations of Kettle River sandstone. Work will begin at once.

PLATE ILLUSTRATIONS.

DORMITORY BUILDINGS AT THE UNIVERSITY OF PENNSYLVANIA, COPE & STEWARDSON, ARCHITECTS. PLATES 24, 25, 26, 27, 28, 29.

THE whole group of buildings, of which a large part is now under way, will cover a block of ground 320 ft. in width by 1,070 ft. in length. The eastern half of this block will be rectangular, while the western half forms a triangle, the base of which abuts on the eastern half, and one side of which is continuous with the side of the rectangle. The buildings will lie close to the street lines, and enclose a large quadrangle on the eastern half and a large triangle on the western half. Near the extreme western end — that is, near the apex of the triangle — the surrounding line of buildings is broken by a small court or quad, open on one side to the street.

The whole group will be enclosed by a high iron fence on the inner line of the sidewalk, and there will be but one entrance for regular use, where, as in English colleges, the porter can see every one who enters or leaves the dormitories.

The students' quarters consist of the usual blocks or staircases, each with its entrance on the inner enclosure. These blocks are separated by party walls, so that the whole system is in the nature of rows of houses. Each stairway gives access to the rooms for an average of about six men on each floor. The system will include a large dining-hall and chapel. There will be studies and sleeping rooms for about one thousand students — and the dining-hall will seat about 650. The drawings published include only that part of the work surrounding the triangle, most of which is now under roof. The dining-hall will be the next part built, and the buildings surrounding the large quad, including the chapel, will follow.

The foundations are of stone on concrete footings — the walls above the ground line of brick, built with a middle air space.

The floors are of steel beams with terra-cotta flat arches. But the roof construction and fourth floor, which is in the roof, are of wood.

The brickwork is laid in Flemish bond, and the headers are vitrified more or less. The mortar is slightly darkened with " French gray," and the joints raked. The bricks are the darkest selection of the ordinary hard brick manufactured by Sayre & Fisher, Sayresville, N. J. The stretchers are dark red and brown, but the headers have little red in them. Some are almost slate color, with a slight mixture of deep yellow. Others have so much yellow mixed with blue as to produce a warm moss green. The result in coloring of the whole wall is very satisfactory.

The style, as will be recognized from the drawings, is " Jacobean."

A TERRA-COTTA STATUE.

On the 22d of February last, there was presented to the city of Perth Amboy, N. J., by her Scandinavian-born citizens, a statue of George Washington, which had been executed in terra-cotta. The figure and base stands 17 ft. 2 ins. high, and is of a light gray or limestone color. We believe this to be the only monument made wholly of terra-cotta in the country, and it admirably demonstrates the possibilities of this material in a new field.

TERRA-COTTA STATUE OF GEORGE WASHINGTON.

The modeling was done by Mr. N. N. Alling, of Perth Amboy, who is a graduate from the Royal Art Academy of Copenhagen. The execution of the whole design is the work of the New Jersey Terra-Cotta Company.

GROWING DEMAND FOR WHITE BRICKS IN LARGE CITIES.

Even to the casual observer it must be apparent that white bricks, as well as those of a light-gray color, are being more extensively used than ever before by the better class of architects throughout the country, in the more important class of buildings.

Of the larger structures that have recently been erected or begun in New York City, a surprisingly large number have exterior walls of these light-colored bricks. This fact is not altogether to be wondered at when the eminent qualifications of this material is considered. In the matter of durability, cost, and pleasing effect, certainly burnt clay will more than hold its own with any other building material; nor can it be said that the use of gray and white bricks is a passing fad; on the contrary, the very fact that architects are using them in buildings that must stand for years as monuments to their skill would disprove such a notion.

It may in truth be said that the tall structures that are being so rapidly reared upon our narrow city streets must of necessity be clothed with material so light in color as not to preclude from these man-made canons all semblance of light, but who will say that the broad avenues extending through the residence portion of our cities are not made more beautiful by the use of these lighter colors in brick for exteriors?

Apropos to this statement, it may be mentioned as a matter of interest, that during a recent visit at the office of the Sayre, Fisher Company, of New York, one of the largest and best-known front brick manufacturing concerns in the country, it was learned that they had recently closed the following contracts for their light-colored bricks, which are made from stiff mud: 1,500,000 white bricks to be used in two large hotels, New York City, for D. O. Mills, Esq., Ernest Flagg, architect.

Seven hundred thousand white bricks for the new Commercial Cable Building, Broad St., New York City, Harding & Gooch, architects.

Three hundred thousand white bricks for the new Bank of Commerce Building, Cedar and Nassau Sts., New York City, James B. Baker, architect.

Seven hundred and fifty thousand white bricks for the new Bowling Green Building, Broadway, New York City, W. & G. Audsley, architects.

The Messrs. Audsley, who practised architecture in England many years before coming to this country, may be said to be enthusiastic supporters of the use of brick in architecture, sharing in this respect the reputation of the late Mr. Street, with whom they had a most intimate acquaintance.

WATCH THIS COLUMN FOR POINTERS.

Messrs. Fiske, Homes & Co., Boston, are the New England agents for the Mannheimer Portland Cement, of which Morris Ebert, Philadelphia, is the sole importer and agent for the United States.

The Manhattan Cement Company, of New York, have moved to new and more commodious offices at 15 to 25 Whitehall Street, New York City.

The New Morrison-Trammell Brick Company, at Rome, Ga., commenced to make brick on the 25th of April with a Chambers machine, recently erected.

The Sayre, Fisher Company will supply one hundred and fifty thousand Roman sized mottled bricks for the Hotel Renaissance, 43d Street and Fifth Avenue, New York City, Howard & Cauldwell, architects.

E. P. Lippincott & Co., of Baltimore, are supplying buff brick for the residences of Mrs. Jenness Miller and Senator Sherman at Washington, D. C.; also the Riggs Insurance Building, for all of which T. F. Schneider is the architect.

THE FAWCETT VENTILATED FIRE-PROOF BUILDING COMPANY have had their system of fire-proofing specified in the Boys' High School Building at Philadelphia. This is one of the largest school buildings in the country.

THE SAYRE, FISHER COMPANY have orders to supply one hundred thousand enameled bricks and two hundred and fifty thousand buff bricks for the new Court House Building at Baltimore, Wyatt & Nolting, architects.

HON. JOHN W. BOOKWALTER will push the work of rebuilding the Lagonda House, Springfield, Ohio, which was recently destroyed by fire. It is his ambition to make it one of the finest buildings in the city. Powhatan cream-white bricks will be used in exterior walls.

THE PERTH AMBOY TERRA-COTTA COMPANY will supply the architectural terra-cotta for two warehouses north side of West 3d Street, between Wooster and Green Streets, New York City, Alfred Zucker, architect; Second Reform Church edifice, Reading, Penn., Geo. W. Beard, architect; the Triangle Building, Rochester, N. Y., J. Foster Warner, architect.

CELADON TERRA-COTTA COMPANY, Charles T. Harris, lessee, are supplying the roofing tile for the new Public Library Building, Kansas City, Mo., for which Smith & Hackney are the architects, A. Van Brunt, associate. Their standard 8 in. Conosera, vitrified red tile has been specified for the residence of A. Kaufmann, Esq., St. Louis, Mo., of which Link & Rosenheim are the architects.

THE PHILADELPHIA & BOSTON FACE BRICK COMPANY'S WORKS, at Boston, are being worked at their fullest capacity. This company makes all colors of plain and fancy brick. Henry W. Savage, Esq., is building on Addington Road, Brookline, Mass., a block of houses in which sixty thousand pressed gray-faced brick will be used; same are being furnished by the Philadelphia & Boston Face Brick Company.

THE PIONEER FIRE-PROOF CONSTRUCTION COMPANY, with headquarters in Chicago, have closed contracts for fire-proofing on the following buildings: Female Hospital and Illinois State Penitentiary, Joliet, Ill., J. H. Lawler, architect; barn for the Fred Miller Brewing Company, Milwaukee, Wis., Wolff & Nevins, architects; barn for the Joseph Schlitz Brewing Company, Milwaukee, Wis., Louis Lehle, architect.

THE STEELTON BRICK WORKS, at Steelton, Penn., destroyed by fire some weeks ago, has placed its order with Chambers Brothers Company, at Philadelphia, for new machinery, and an entire outfit of Chambers machinery will be installed as soon as possible. This company has consolidated the Zimmerman Brick Yards at Harrisburg, Penn., which were equipped with Chambers machinery last season.

THE NEW JERSEY TERRA-COTTA COMPANY is furnishing architectural terra-cotta for the new synagogue at New Haven, Conn., of which Brunner & Tryon are the architects; also for the residence for Spencer Aldrich, Esq., 72d Street and West End Avenue, New York City, G. I. Schellenger, architect. Same company will also furnish the terra-cotta for the large office building on Broadway, New York City, for Messrs. Weil & Mayer, for which Claverdon & Putzel are the architects.

THE NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY has been exceptionally busy during the past winter and spring of present year. The work for the seventeen-story Astor Hotel, Fifth Avenue and 34th Street, New York City, on which it has been engaged is now well advanced, and the contracts which have been closed, or are in course of adjustment, promise an equally prosperous summer and fall. The prevailing colors this season are white, cream, buff, and gray, in the production of all of which this company has been eminently successful. The wonderful uniformity of its (limestone) gray has often been referred to by correspondents of THE BRICKBUILDER.

THE FAWCETT VENTILATED FIRE-PEOOF BUILDING COMPANY, of Philadelphia, closed the following contracts during the month of April: —

American Baptist Publishing Society Building, Lombard and Juniper Sts., Philadelphia, Penn.

Store Building, for Hull & Morton, Pittsfield, Mass.

The Roberts Warehouse, Boston, Mass.

Club House, for Philadelphia Base Ball Club, Philadelphia, Penn.

Physicians' & Dentists' Building, Philadelphia, Penn.

St. Francis Hospital, Pittsburgh, Penn.

THE EXCELSIOR TERRA-COTTA COMPANY, of New York, have closed the following contracts for architectural terra-cotta: New building for *Munsey's Magazine*, at New London, Conn., Wm. B. Tuthill, architect. Spingler Building, Union Square, New York City, Wm. H. Hume & Son, architects. Warehouse, Washington Place and Greene Street, New York City, Robert Maynicke, architect. Edison Building, Atlantic Avenue, Boston, Winslow & Wetherell, architects. Murray Hill Theater, Lexington Avenue and 42d Street, New York City, McElfatrick & Son, architects. Twenty-one story office building for the Commercial Cable Company, Broad Street, New York City, Harding & Gooch, architects. Hartford Life Insurance Building, Hartford, Conn., F. R. Comstock, architect. Building for the Lynn Gas & Electric Company, Lynn, Mass., J. T. Kelly, architect. Office building for the Mechanics' Bank, Court and Montague Streets, Brooklyn, N. Y., Geo. L. Morse, architect.

NEW TRADE LITERATURE.

THE up-to-date catalogue or trade pamphlet is one that contains a fund of information that is of general interest pertaining to the particular trade it represents. There can be no doubt that in the compiling of one of these trade publications every effort is made and no expense spared by the enterprising merchant, to place before his readers only such data as may be considered authentic, the result being that we frequently find them not only interesting, but valuable for reference. Especially is this true of the booklet just issued by Morris Ebert, Philadelphia, importer of the Mannheimer Portland Cement.

Among the many interesting features contained in this little volume may be mentioned that part which is devoted to rules and suggestions regarding the various uses of Portland cement, tables showing the relations between the Fahrenheit and Centigrade or Celsius thermometers, contents in gallons of each foot in depth of cisterns or wells, also other tables giving the metric system of weights and measures, and for converting of kilograms per square centimeter into pounds avoirdupois per square inch.

Copies sent on application to Morris Ebert, 302 Walnut St., Philadelphia, Penn.

ANOTHER valuable book for reference in the trade publication line is the catalogue of the Empire Fire-proofing Company of Pittsburgh and Chicago. This volume is liberally illustrated with the constructive details of their system for fire-proofing floors, partitions, ceilings, and columns, and contains, besides, much valuable information regarding the construction of same.

Terra-cotta wall and chimney copings, also fire-clay flue linings, are illustrated and described in the same manner. These, with illustrations of some of the more important buildings for which they have furnished fire-proofing, make a most attractive catalogue.

The Tiffany Pressed Brick Company, of Chicago, have issued a neat little booklet brimful of information, put into concise form, regarding enameled bricks, of which they are large manufacturers.

Following we give some quotations which are of general interest: —

These bricks are made in English and American sizes, of all shades and various shapes, including Roman, and are guaranteed to be equal in quality to the best English, and superior to them in some respects.

SIZES OF OUR ENAMELED BRICK.

English, 9 by 3 by 4½ ins.
American, 8¾ by 2¼ by 4 ins.
Roman, 12 by 1½ by 4 ins.

REGULAR STOCK.

Stretchers, quoins, octagon, round end, splay, and soaps. Radius and special shapes made to order on reasonable notice. Our works being under cover, orders can be gotten out at any time. Full scale drawings required for special shapes.

COLORS.

White, ivory, cream, buff, brown, chocolate, blue, green, granite, etc.

Beautiful effects in fireplace, mantel, and chimney work may be produced with the various shapes and shades of our enameled goods and with the aid of the architects' working plan, the bricks can be set by any experienced mason.

We wish it to be specially noted that our bricks are NOT GLAZED but are THOROUGHLY ENAMELED, the enamel forming a complete and *inseparable* union with the bricks, which will stand for inside or outside work in any climate.

It should be noted that while 7⅓ brick of the ordinary (American) size are required per superficial foot of wall, only 5⅓ are needed in the English size, a difference of about 33⅓ per cent. in favor of the latter, which, with the saving in laying and materials, makes the larger brick cheaper to the contractor, at, say, $90 per M. than the smaller brick at $70 per M.

WASHINGTON MONUMENT.

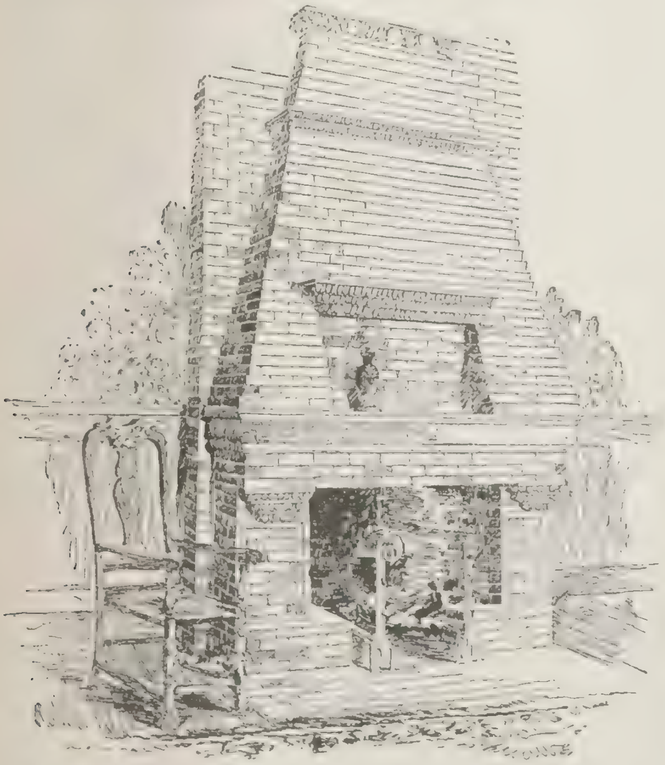
As the towering height of the **Washington Monument** exceeds that of all other similar structures in the world, so does the **"Triumph" Press** surpass all other Brick Presses as the Ideal of Perfection, in Simplicity, Durability, Capacity, and Money-earning qualities.

The **cost** of making **pressed bricks** on the **"Triumph"** is **less** than on **any other press** and **less** than by **any other known method** of making bricks, while the **quality** of its product is **unequaled.**

KULAGE MACHINE WORKS,
College Avenue, St. Louis, Mo.

We construct and equip brick plants of any capacity complete. We also manufacture the "Triumph" Gathering and Loading Machine — a money-saver and money-maker for the brickmaker. This machine gathers the previously plowed and dried clay from the field and loads same into carts or wagons. With two or three horses and one driver, its capacity is the gathering and loading of as much clay as twenty men with shovels would do **The benefits to be derived of one machine are enormous.** Progressive brickmakers will please write us.

KULAGE MACHINE WORKS, College Ave., St. Louis, Mo.



HERE IS ONE

Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

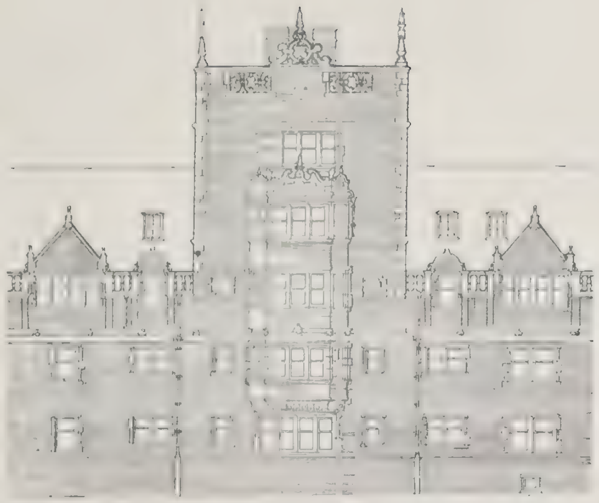
JUST THE THING

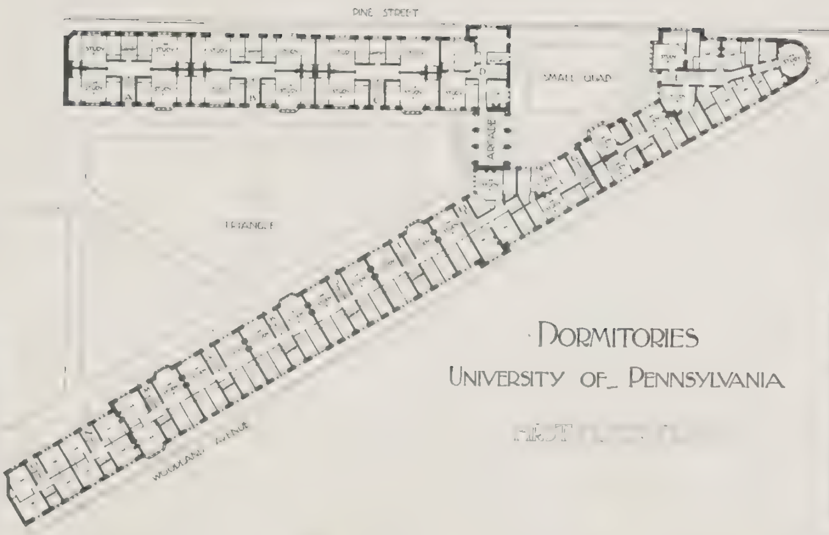
FIREPLACE MANTELS

MADE OF MOULDED BRICK

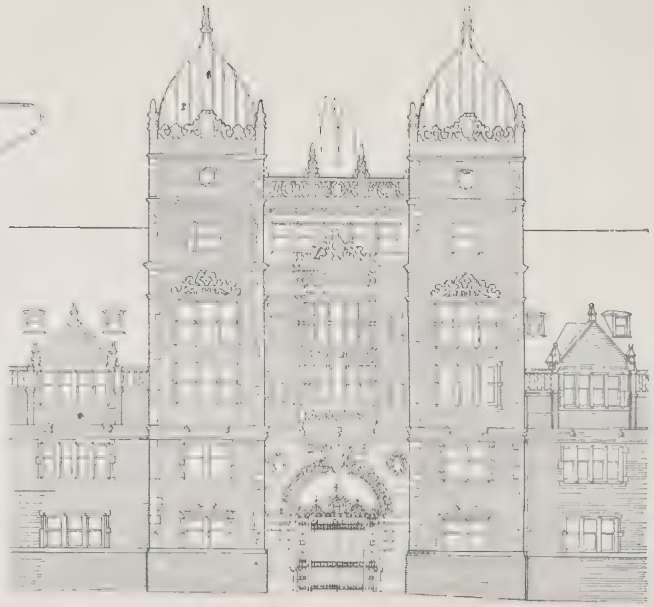
In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

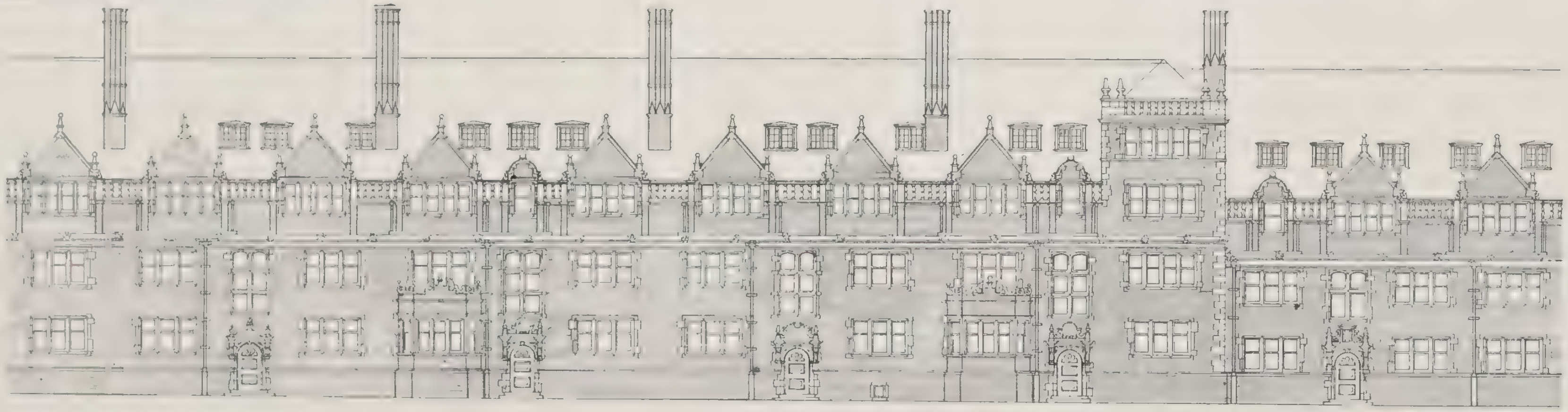
PHILA. & BOSTON FACE BRICK CO.,
No. 4 LIBERTY SQUARE, BOSTON, MASS.





·DORMITORIES
UNIVERSITY OF PENNSYLVANIA
FIRST FLOOR PLAN



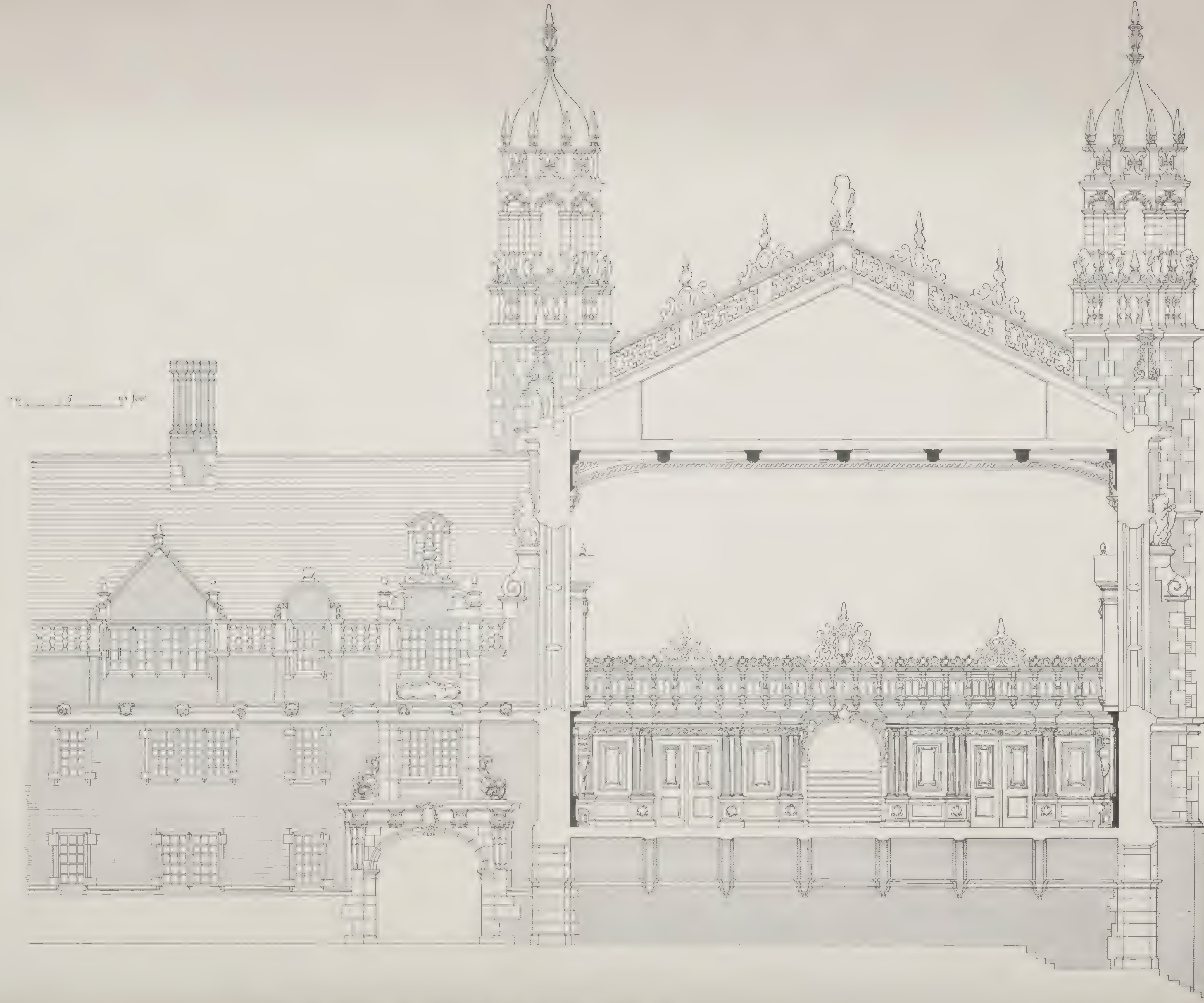


Scale of Feet

ELEVATION ON THE TRIANGLE.

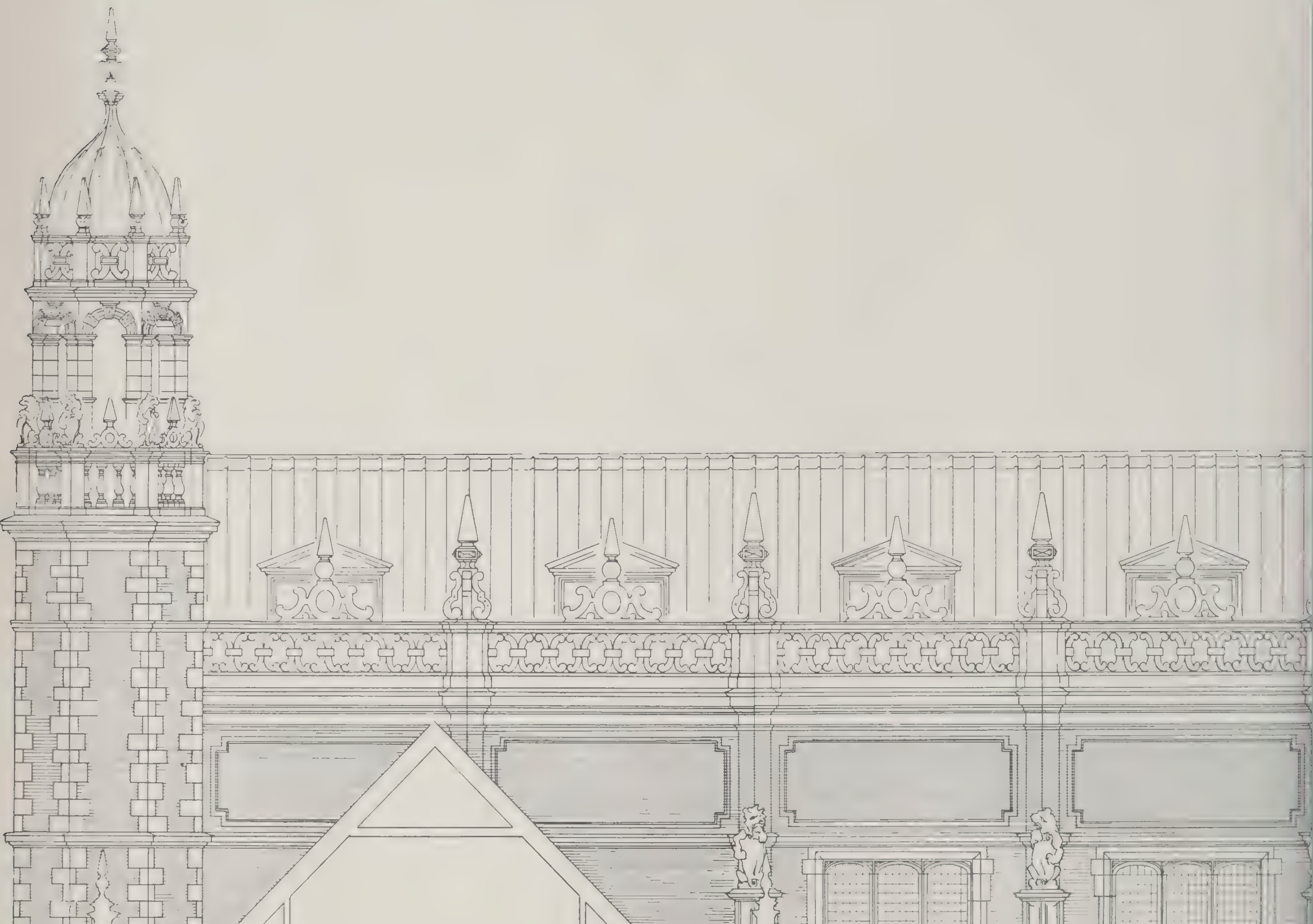
DORMITORIES: UNIVERSITY OF PENNSYLVANIA: WOODLAND AVE. BLOCK.

Cope & Stewardson,
Architects,
320 Walnut St. Phila., Pa.



DORMITORIES, UNIVERSITY OF PENNSYLVANIA. SECTION THROUGH DINING HALL.

COPE & STEWARDSON, ARCHITECTS.



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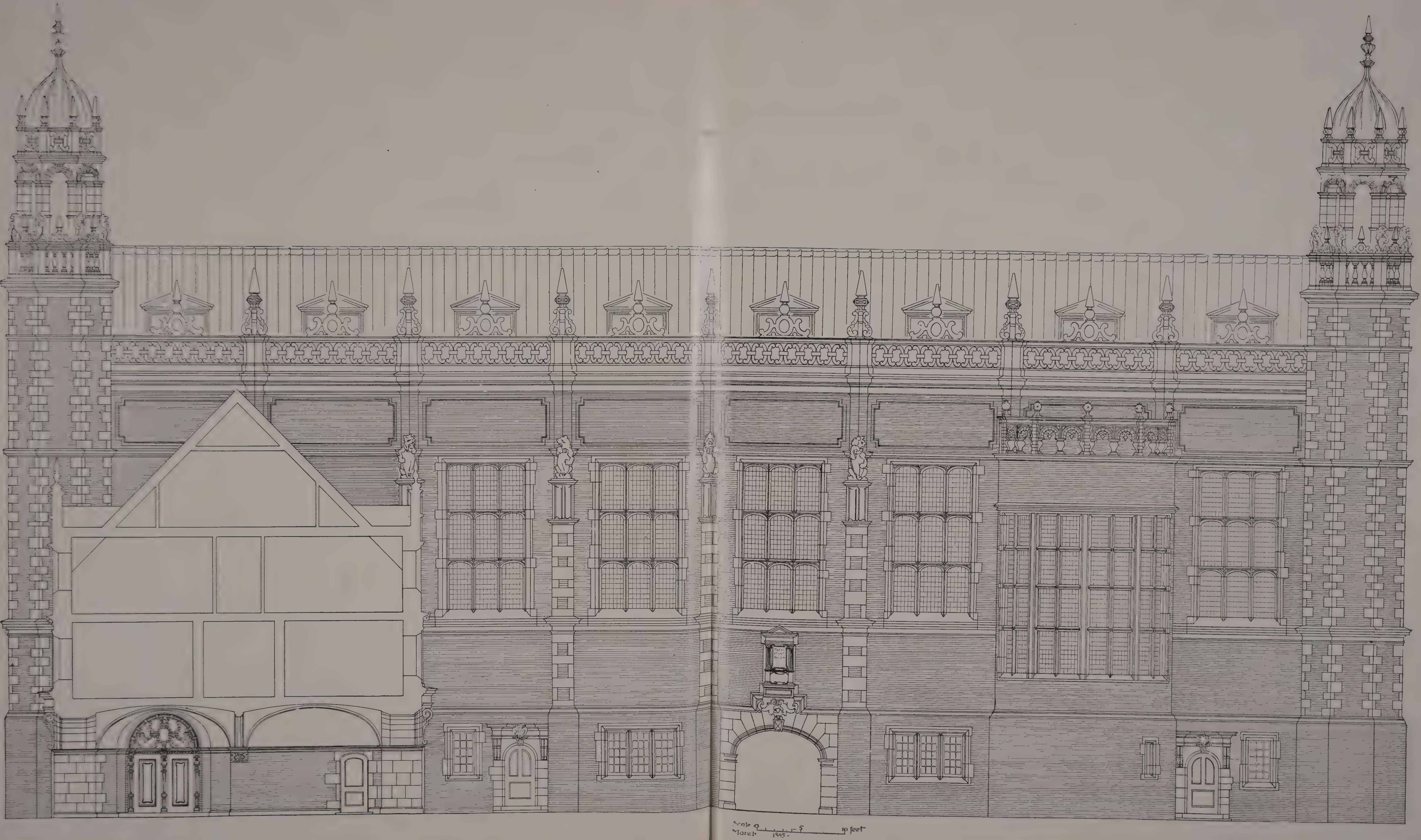

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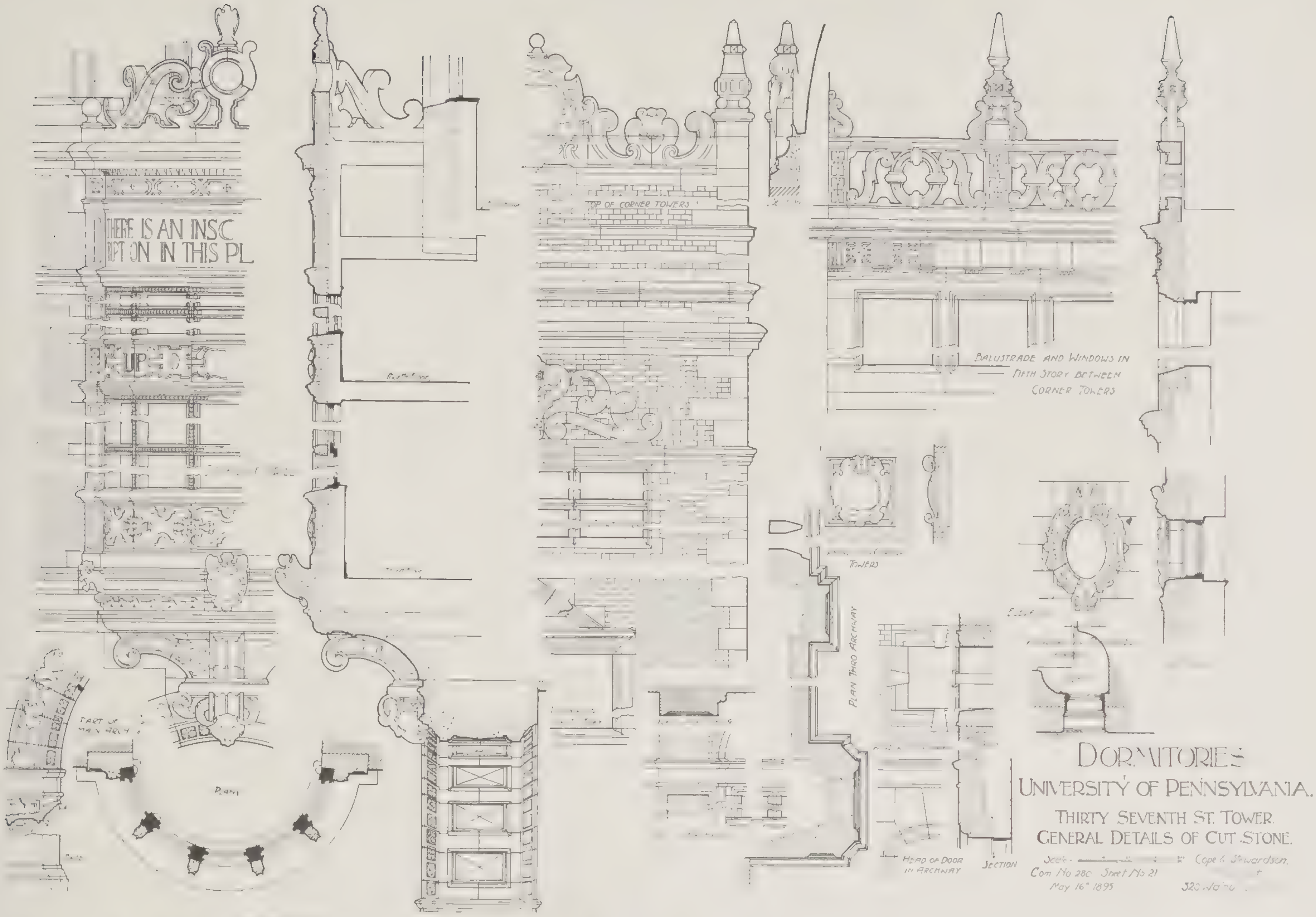
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THIRTY SEVENTH ST. TOWER.
GENERAL DETAILS OF CUT STONE.
Scale
Cope & Stewardson.
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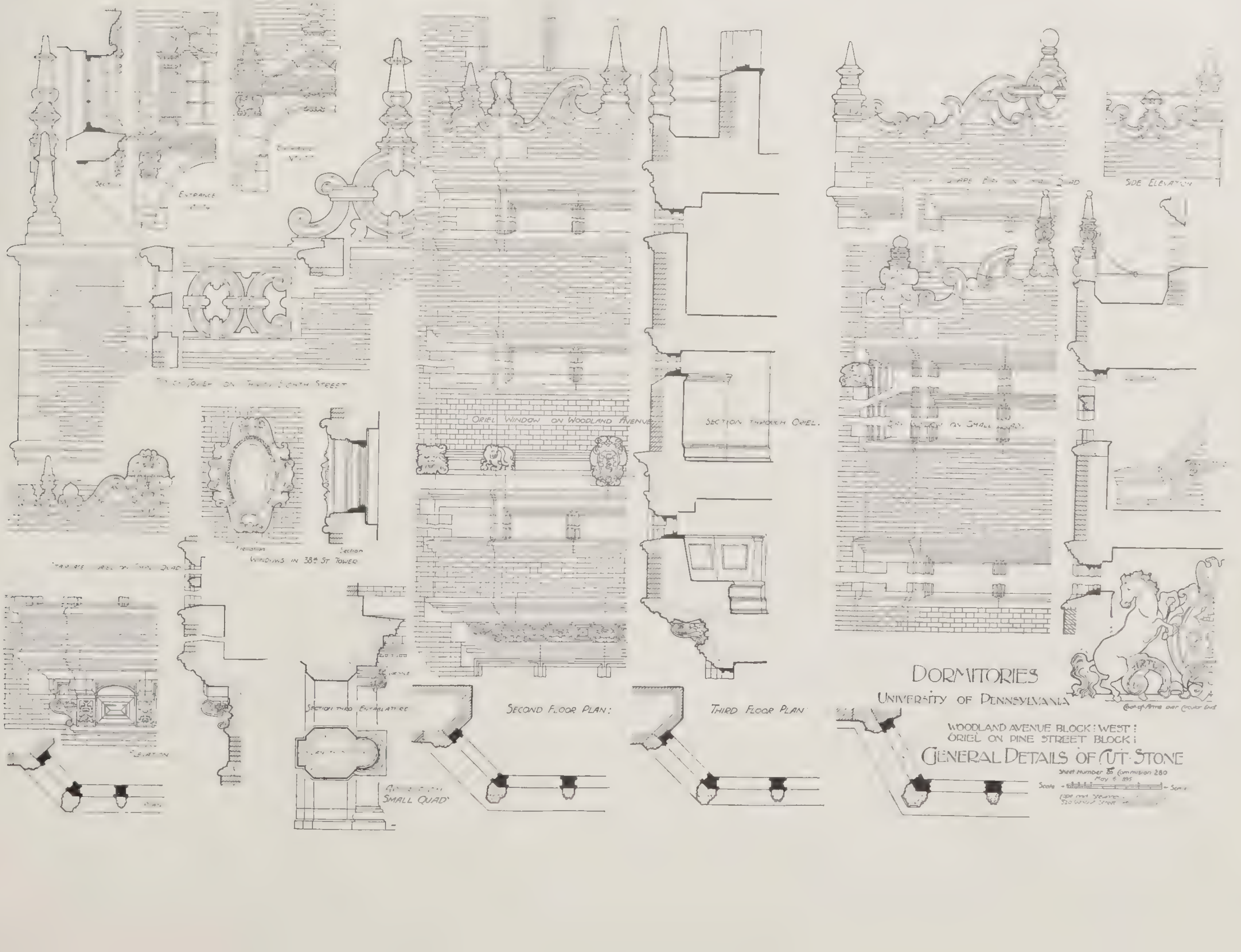
May 16th 1895
320 Walnut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SECOND FLOOR PLAN
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UNIVERSITY OF PENNSYLVANIA
Coat of Arms over Circular End
WOODLAND AVENUE BLOCK: WEST:
ORIEL ON PINE STREET BLOCK:
GENERAL DETAILS OF CUT STONE
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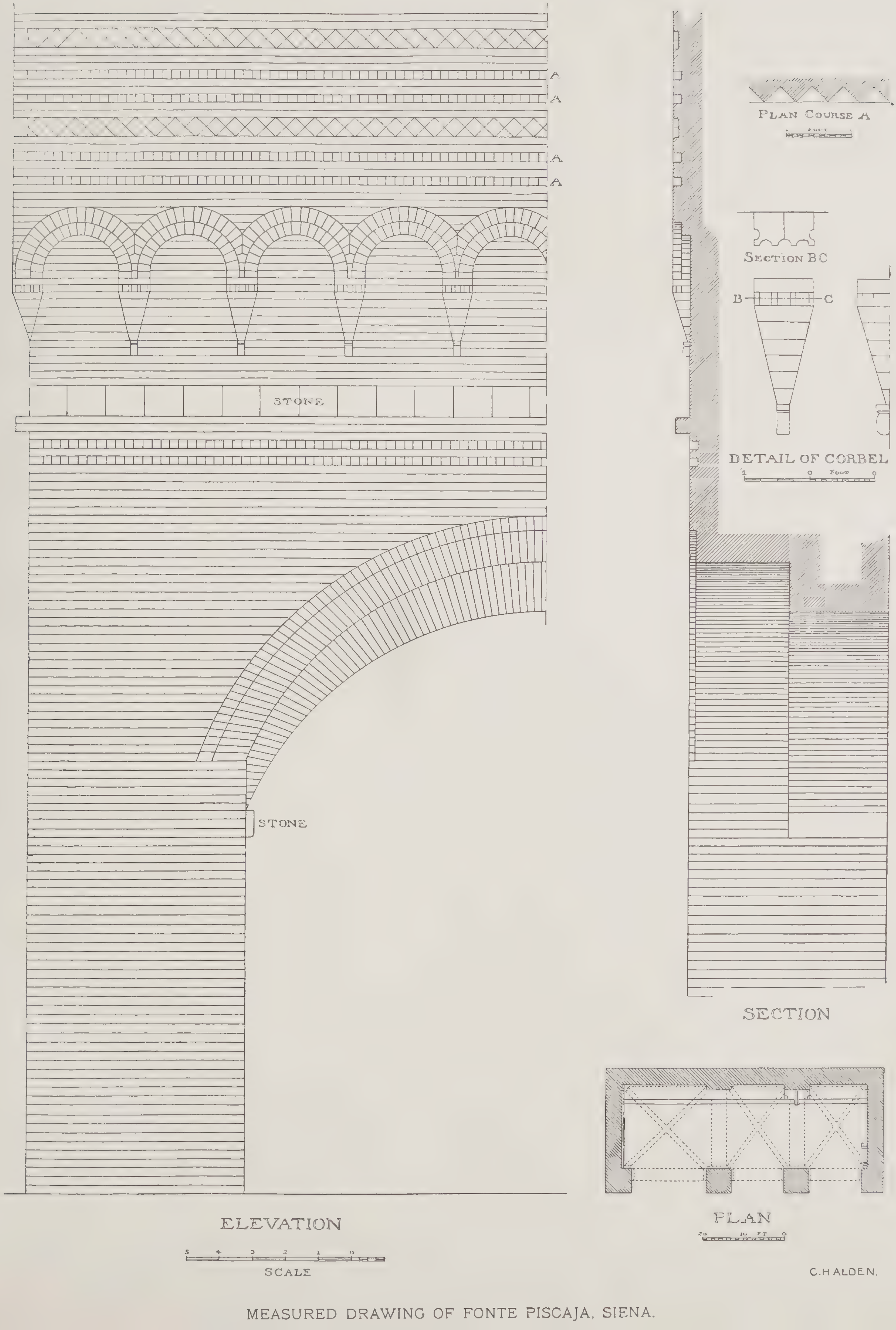

ELEVATION

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PLAN

C.H ALDEN.

MEASURED DRAWING OF FONTE PISCAJA, SIENA.

VOLVME
V
JUNE
1896
No. 6

THE
BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

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Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

THE brick masonry tests made under the direction of the Royal Institute of British Architects, which were described in our last issue, comprise a line of investigation which might be pursued to a considerable extent in this country with great advantage to our manufacturers as well as to our constructors. We are inclined to believe that the safe resistance of brickwork is overestimated in this country. The bricks themselves which are at our disposal are thoroughly first class in every respect, and are amply strong for the duty which is put upon them, but the strength of a brick pier or wall cannot be measured by the strength of the bricks. The mortar which is used in the construction is the weakest element. Consequently, tests of brick piers are, as a matter of fact, tests of mortar joints. It will be noticed, by reference to the British experiments, that the piers began to fail in nearly every case by the mortar crushing out from the joints, and though the bricks themselves were crushed, we cannot call the ultimate resistance of a brick construction any more than the limit of loading without preliminary cracking or crushing. As soon as a pier fails at all, it is worthless. Now the best of mortar will hardly sustain more than 25 or 30 tons per foot. Indeed, we very much doubt whether mortar such as actually goes into a building laid under the conditions which must exist in every commercial structure, would stand over 20 tons without being disintegrated beyond the safety line. And when it comes to the ordinary lime mortars such as are used in some structures, considering farther that brickwork in a building is generally loaded as high at first as it ever is, and that lime mortar has no opportunity to acquire any great degree of hardness inside of a number of months, it does not seem rational to believe that lime mortar under the most favorable conditions would resist more than, say, 10 tons per foot. Consequently, if we are to take even so low a factor of safety as 4, it is not wise to overload brickwork, even of the best description, with more than 5 or 6 tons per foot.

This is a purely theoretical assumption. There are so few practical facts to draw upon, relating to American brick construction, that an argument of this sort is necessarily vague. The tests which have been made heretofore of brick piers, while excellent in their way, have demonstrated the strength of bricks rather than of construction, and it is to be hoped that an opportunity may arise for conducting a set of experiments with our materials; not upon selected piers built by selected workmen with selected materials, but upon ordinary every-day construction such as the architect and the builder has to submit to. We know that very few brick walls are laid properly. We know that the mortar is the vital portion of the structure, because it is the weakest, and yet it is usually slighted or used injudiciously, but it is just such slighted or injudicious work about which we need information.

The thought naturally arises, if our brick piers are not capable of sustaining more than 20 or 25 tons per square foot, why should we object to bricks which do not exceed 60 or 70 tons per foot ultimate resistance? It seems to us the answer to this conundrum is not in the line of resistance to crushing so much as to wear. A soft burned brick, or one which is made of soft material, while undoubtedly amply strong, by comparison with the mortars, to sustain under proper conditions the loads put upon it, will not stand the wear, is more apt to disintegrate in time, and cannot be depended upon for uniformity. A good, first-class brick, either common or face, should show an ultimate resistance of from 750 to 1,000 tons per square foot, if we are to have any confidence in its endurance.

Unfortunately, the opportunity for such tests as were made in London does not exist in this country. The capacity of the Watertown testing machine is 800,000 lbs. The machine which was used in England had a capacity of 1,000,000 lbs., and, to be really conclusive, a machine such as we are referring to should have a capacity of at least 1,500,000, and better yet, 2,000,000 lbs. With the latter capacity it would be possible to crush piers built under ordinary conditions 3 ft. square. A small pier is always proportionately stronger than a large pier, and just as in the testing of beams and columns our scientists have grown to the conviction that it is essential to break full-size sections, and the larger the better, in order to determine the unit resistance, so in order to properly gauge the strength of our masonry, the experiments should be made upon the largest size sections possible. The construction of such a testing machine would involve a great deal of money, but would be well worth while, judged by the probable results.

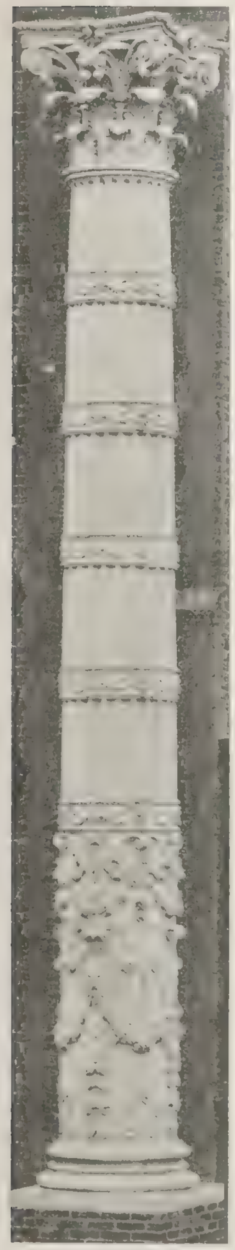
WHEN doctors disagree, it must be expected that laymen shall be of varying mind. To judge by recent New York expressions, the architects there are a unit against high building; but from the columns of the *Inland Architect* comes an opinion on the other side by Mr. Louis H. Sullivan, which certainly has the charm of frank conviction.

"What is the chief characteristic of the tall office building? And at once we answer, it is lofty. This loftiness is to the artist-nature its thrilling aspect. It is the very open organ tone in its appeal. It must be in turn the dominant chord in his expression of it, the true excitant of his imagination. It must be tall, every inch of it tall. The force and power of altitude must be in it, the glory and pride of exaltation must be in it. It must be every inch a proud and soaring thing, rising in sheer exultation that from bottom to top it is a unit without a single dissenting line — that it is the new, the unexpected, the eloquent peroration of most bald, most sinister, most forbidding conditions.

"The man who designs in this spirit and with this sense of responsibility to the generation he lives in must be no coward, no denier, no bookworm, no dilettante. He must live of his life and for his life in the fullest, most consummate sense. He must realize at once and with the grasp of inspiration that the problem of the tall office building is one of the most stupendous, one of the most magnificent opportunities that the Lord of Nature in His beneficence has ever offered to the proud spirit of man.

"That this has not been perceived — indeed, has been flatly denied — is an exhibition of human perversity that must give us pause."

ILLUSTRATED ADVERTISEMENTS.



A STRIKING instance of the old régime and the new standing side by side may be seen in the accompanying illustration, which is omitted from the advertisement of the New York Architectural Terra-Cotta Company on page xxviii, for the reason that the design which is published this month (being the one submitted by Will S. Aldrich in the competition recently held by this company, and which took third prize) will not admit of an illustration being made therein.

The modern office building of eleven stories, on the right, stands on the corner of State and Devonshire Streets, with a frontage extending into Washington Street, Boston. The three first stories are stone, and the remaining eight terra-cotta and brick of a bright golden buff, that help to relieve the dulness of this rather somber neighborhood of narrow and winding streets of a bygone time with the comparatively high buildings of to-day. Mr. T. M. Clark, of Boston, is the architect.

To the left is the quaint and unpretentious old brick State House, still in a good state of preservation, on which remains a somewhat unique relic of colonial rule, prior to an episode that is sometimes referred to, and is said to have occurred more than a century ago, in connection with some tea in Boston Harbor.

The adjoining column is one of eight similar ones used on the new City Hall, Elmira, N. Y., now in course of erection. It is of Renaissance design, very rich in detail, and above the first story is executed wholly in gray terra-cotta, with brick made specially to match, both being supplied by The New York Architectural Terra-Cotta Company. The building is exposed on all sides, and when completed promises to be worthy of the city and of its architects, Messrs. Pierce & Bickford, who have achieved a well-deserved distinction among their fellow-citizens.

In the advertisement of Charles T. Harris, lessee, on page xxvi, is illustrated a residence in Chicago, of which Jenny & Mundie are the architects.

The extensive plant of the Sayre-Fisher Company is illustrated in their advertisement on page xvii.

The Hide and Leather Bank Building, New York, is shown in the advertisement of the Clinton Metallic Paint Company, page xxxi, while an office and store building on Broadway, New York, of which Ralph S. Townsend is the architect, is shown in the advertisement of the New Jersey Terra-Cotta Company, page viii.

Another interesting illustration is that of a Guastavino fireproof floor as used in a large manufacturing building. This may be seen in the advertisement of R. Guastavino, on page xiv.

THE furnace for testing columns and their protection erected by the committee appointed to conduct a series of fire-proofing tests in New York City is now completed.

A preliminary test of the furnace and of an unprotected steel column was made recently. Gas heat was used measured by pyrometers of extreme delicacy. Hydraulic pressure was used at the base of the column erected. The tests were entirely satisfactory, and it was expected that the regular tests would begin early in June. At present it is probable that only columns and their protection will be tested, as the furnaces for testing floor arches are not yet finished.

THE articles on "Architectural Rendering in Pen and Ink," by Mr. D. A. Gregg, which were begun in the April number of THE BRICKBUILDER, will be continued in later numbers of this year. Through an oversight, "To be continued" was omitted from the end of Mr. Gregg's first article.

THREE well-known Boston architects will act as judges in The Barta Press Competition; names to be announced in our July number.

BRICK PIER TESTS.

EDITORS OF THE BRICKBUILDER.

Dear Sirs :— I have just read with much interest the article by Mr. Blackall, on the "Resistance of Brickwork," in the May number of your journal.

I have made a considerable study of the strength of brickwork, and the working loads which I have given in my pocket book are the results of my conclusions on the matter. I believe that 12 tons for Eastern hard burned common brick in cement mortar, and 9 tons for a similar grade of work of Western brick, is as great a resistance as it is safe to depend on, unless unusual precautions are taken to get a first-class job.

If one examines the way in which all the piers tested by the Royal Institute of British Architects failed, and those tested some years ago at the Watertown Arsenal failed in practically the same way, it will be noticed that in most cases failure takes place by the splitting and bulging out of the pier, and not by direct crushing of the brick or mortar, showing that the pier is weakest in the bond and the tensile strength of the brick. From this it would appear that the strength of a brick pier might be materially increased by building into the horizontal joints every few courses, iron clamps, which should turn down at each end, and alternate clamps, laid at right angles to each other. As thorough bonding of the bricks themselves as is possible will also add to the strength of the pier. It would be very interesting if tests could be made of piers built with and without the iron clamps. In regard to New England bricks, and particularly those that used to be made in Cambridge, I have never yet seen bricks that were equal to them in strength and hardness. At the time I made the tests for the Mechanics' Charitable Association of Boston, I found it almost impossible to dress the bricks to parallel surfaces. We first tried a stone-cutter's chisel but there was so much flint in the bricks, that the tool would not cut them. I finally put them on a rubbing bed and faced them in that way, but it took a long time. As to the relative values of mortars, it has always seemed to me that the chief value of cement over lime mortar for brickwork not exposed to dampness lies in the fact that the cement mortar attains its strength much quicker and has greater adhesion to the bricks.

Lime mortar hardens so slowly, that in a four or five story building, built at the rapid rate now customary for business blocks, the mortar in the lower story is comparatively green, even when the walls are topped out, and of course the thicker the walls, the more slowly the mortar hardens.

DENVER, June 2, 1896. F. E. KIDDER.

THAT eminent architect, the late Mr. Street, R. A., did more than any one else, in modern times, to further the use of bricks in really grand edifices. During his travels in Italy, he was struck by the simple grandeur of many palatial buildings in that country, which taught him, more than any other object-lesson could possibly do, the fruitful results of utilizing our favorite material. His own works in this country prove how true he was to himself in having bricks specially made whenever he had a large brick building in hand. We would that more architects would follow his example. It is true that a fair amount of bricks, specially designed by the architect, is yet made; but we look to that awakening that must inevitably come, when Street's brickwork shall be appreciated at its full value. — *British Brickbuilder.*

ALL designs intended for The Barta Press Competition should be sent in season to reach this office not later than July 1.

THE names of the prize winners in the Competition will be given in our July number.

THE prizes will be awarded on receipt of the report of the judges.

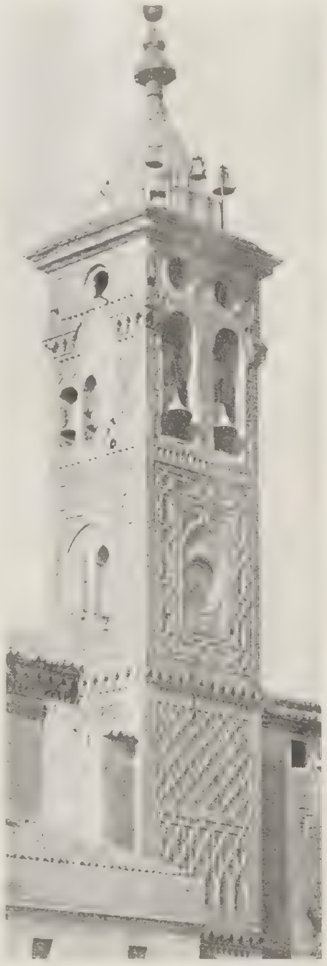
Spanish Brick and Tile Work.

BY C. H. BLACKALL.

TOWER OF SAN GIL.

BURNT clay in its various modifications has been the most extensively employed material of construction in nearly all times and in all countries, and its use has been followed by some remarkably successful results, notably, such as were evolved on the plains of Lombardy and in the Hanseatic regions of Northwestern Germany. To a lesser extent, also, examples of successful terra-cotta and brickwork are to be found in nearly all countries and accompanying all of the historic styles, from many of which valuable and interesting examples may be drawn for help in our modern architectural needs. This is especially true of Spain, which, while in one sense occupying a secondary position in the ceramic arts, nevertheless affords some most brilliant examples of what may be done with burnt clay.

Brick and terra-cotta work in Spain bears throughout the imprint of being an exotic. The country is peculiarly well endowed with excellent building stones. Nowhere else in the world can there be found a material which will take finish so readily and hold it so firmly as the beautiful, fine-grained, pinkish-yellow sandstone which comes from the neighborhood of Salamanca. Consequently, with ample means at command during its palmiest days, and with the best of stone, marble, and granite to choose from, we do not find a development of the burnt clay arts which might have been expected both by reason of the successful way in which the materials have been handled in some instances, and by the peculiarly adaptive nature of the people themselves, who, stubborn and unyielding as they have been in political matters, have shown a marvelous pliability and extreme powers of assimilation in the imaginative arts. Spain owes the best of her brick and terra-cotta work to an alien race; or, at least, we are accustomed to call the Moors aliens, though a possession of the country for eight centuries,

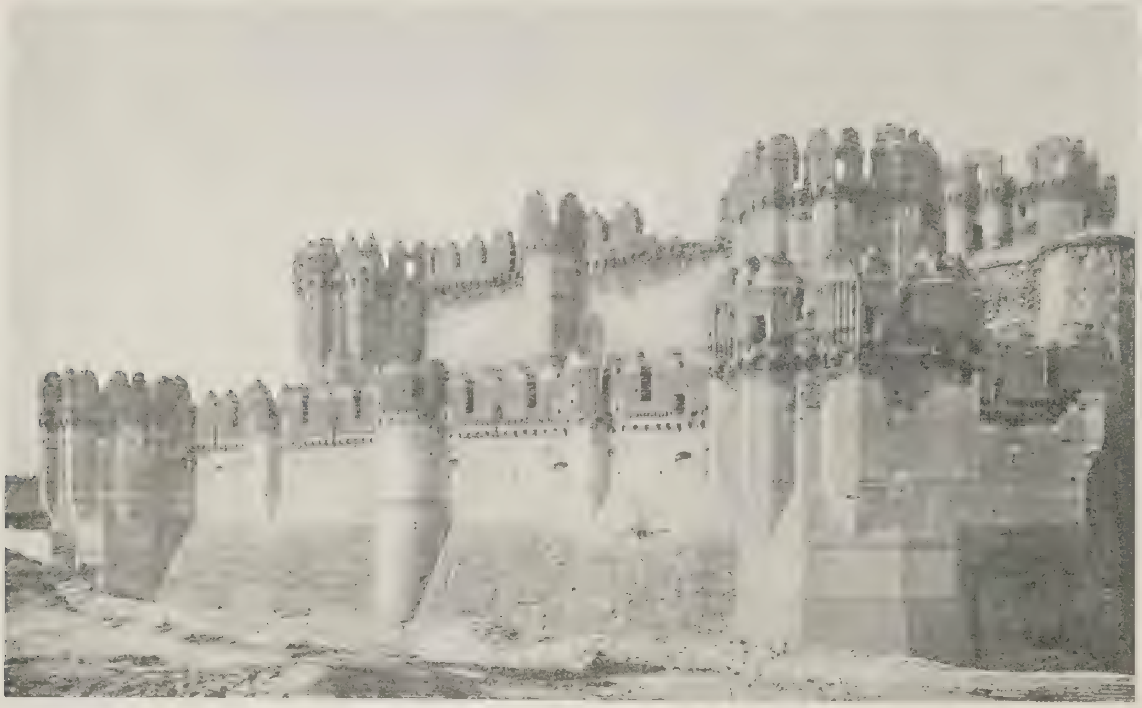


TOWER OF SAN MIGUEL.

and the evolution of one of the finest types of civilization existing in Europe prior to the Reformation, ought surely to have entitled that gifted people to be classified as peculiarly Spanish. With their expulsion from the peninsula, the use of terra-cotta as a building material began to diminish, being succeeded in historic style by the elaborately tortured stone-work of the Renaissance; but the influence of the Moorish arts in both design and construction was dominant during many subsequent generations, and nearly all the brick and terra-cotta work which is now found in Spain is decidedly Moorish in its character, even when not directly the product of the exiled race. The Arabian arts were essentially decorative; they were never constructive except as an incident, and the decorative tendency is strongly marked even in so constructive a material as brick; but the Moors and their Spanish successors achieved their best successes only when the element of color was incorporated in the brick and terra-cotta designs. The enamels and glazes which the Moors knew how to use so skilfully are without a peer as decorations of architecture. No other people, with the possible exception of some of the Persian tribes, have ever succeeded in so fitly combining bright, vivid color with architecture, and hardly anywhere else in the world do we find color so essential a part of design as in the types of the highest development of Moorish architecture.

In considering the general topic, let us take up first the dryer and less interesting manifestations. The burnt clay products have found many advocates, but few historians. Consequently, chronology plays a slight feature in any record of Spanish work. We know that some buildings are old and some are young. We can tell by inference and appearance which belong to the early Moorish and which to the Renaissance. Beyond this the records are obscure, and it is not worth while to attempt any nice discrimination in periods, but rather to study the actually existing remains by localities. These naturally group themselves in a succession, beginning on the arid plains of the northeasterly portion of Spain, and ending in the vivid coloring of the enameled terra-cottas in the Alhambra.

The oldest examples of Spanish brickwork which possess any architectural pretense are found in the mountainous regions north of Madrid. In the little town of Coca, near Segovia, are the remains of a vast fortress, or Gothic chateau, dating from the fifteenth century. It is to all outward appearance built entirely of brick, but the walls are actually constructed in large part of masses of concrete or coarse rubble, faced with brick. The structure is in a sad state of dilapidation, but enough remains to give a very clear idea of the general design. The walls are heavily machicolated, and a striking result is produced by the use of brick rounded on the edge and laid so as to produce heavy vertical reedings. The appearance of stone trimmings is simulated by bands of stucco, now mostly peeled off. The bricks are of the old Roman pattern, a foot or more square and quite thin, and are laid with very heavy joints. At Medina del Campo, near by, is another structure of the same type, the ancient fortress of the Mota, which is historically of interest as being the place where Queen Isabella died, in 1504. Both of these examples are interesting from their dignified masses and the simple, effective treatment of detail, and recall in many respects the brickwork of the south of France, notably about Albi. A very interesting effect is obtained, possibly by hazard, but which is none the less effective, by the small openings which are left in the walls at frequent intervals, and which were undoubtedly the resting-places for the scaffolding used when the work was erected. This is a treatment which is often found in the later Spanish work, and always counts for a great deal. Every one who has had to do with the designing of brick structures appreciates the advantage of a simple unbroken wall surface, but at the same time, the necessity arises for relieving the monotony of this surface, and in hardly any way can it be accomplished so easily as by this omission of a brick or two at regular intervals. The castles at Medina and at Coca are very much neglected, and apparently little interest is felt in them by the Spanish Government. The bricks used are of a very pale buff color. Neither of these designs offer any of the peculiarities of Moorish architecture, though it is quite probable that both were built by Moors.



CASTLE AT COCA.

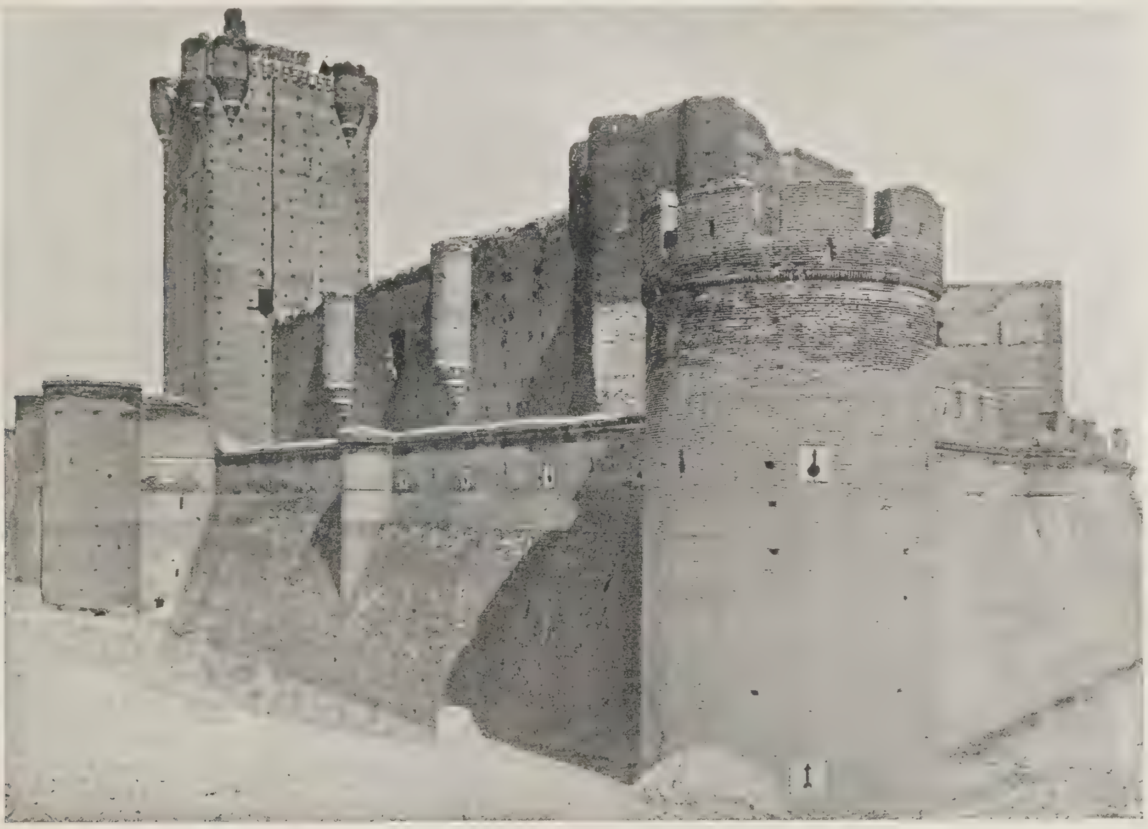
The city of Saragossa contains more interesting brickwork than any other of the Spanish towns. The most prominent structure is the so-called leaning tower, which was built in 1504. It stands entirely isolated in the center of a small square, and reaches to a total height of 276 ft. It measures a little over 40 ft. at the base, is in plan an octagon, and is constructed entirely of brick, but with a variety of forms, ornament, and details, recalling both the Gothic and the Moorish styles. Each story of the tower is treated in a different manner. The basement is simple and massive, and the first story is formed in the plan of a star with reentrant angles. The corner turrets of the upper portion of the tower, the pointed arched windows, and the picturesque roof, are especial features which mark this tower in an individual manner. There is nothing like it anywhere else in the world, and in many respects it is one of the most successful examples of the use of an humble material to produce a monumental effect. None of the details are helped out by stone or terra-cotta. As in the previous examples, the bricks are of the Roman type, long and flat, and are laid with a very thick bed of mortar. It is intensely interesting to study this design in detail, as we can see how cleverly the effect is obtained with a minimum of effort. The tower leans so as to overhang the base by more than 8 ft. This inclination seems to have been produced deliberately, for at the base it is much less than in the main portion of the tower.

Saragossa is peculiarly rich in brick towers. The one which forms a portion of the church of San Pablo is more markedly Moorish in the character of its detail than the leaning tower, and is much more graceful in its proportions, though not so elaborated or varied in treatment. It is shown in the distance of photograph of the leaning tower. It is octagonal in plan, rising almost unbroken to a height of about 100 ft., above which it is pierced on each of its faces by a pointed mullion window. Above this are bands of diaper work in relief and two tiers of arched openings, with a crowning roof somewhat like that of the leaning tower. The detail could hardly be simpler, and certainly could not be any more effective, judged by the value of the results. The tower of San Gil is still more Moorish in sentiment, but is much more dilapidated than either of the preceding, and is not as picturesque nor as interesting in detail. The same is true also of the tower of San Miguel. The surface treatment of a plain brick wall, which forms so noticeable a feature of the lower portion of this tower, is one of the most effective employments of brick which has ever been devised. It occurs in nearly all of the Hispano Moorish work, and is formed usually of nothing but the simple rectangular bricks, but it has all the effect of a lace mantilla thrown over the surface of the construction and is used with charming effect. The brick used in all of these Saragossa structures is of a pale buff color not particularly pleasing in tone.

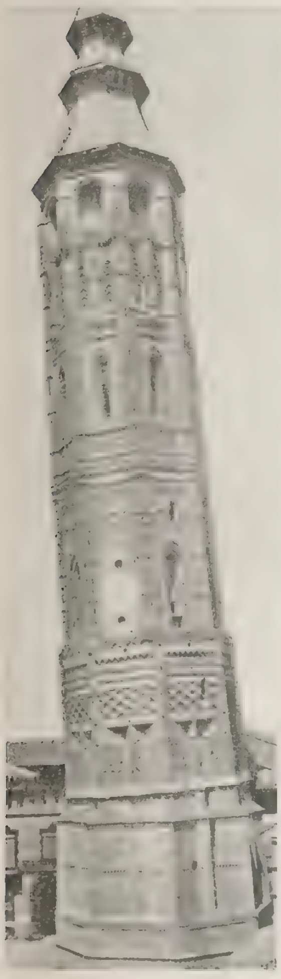
It will be noticed that the decoration of all of this work is essentially superficial, and bears no distinct relation to the construction, following in this respect the example of nearly all Arabian art. The leaning tower borrows a slight Gothic sense of constructive ornamentation, but the fretful diaper treatment shows a certain lack of correlation between the treatment of mass and the microscopic conception of detail. It must be admitted, however, that such treatment does really decorate the construction, and, considering the nature of the styles and the materials, these towers are designed very successfully.

The Spanish architects of the early Renaissance or late Gothic period owe very largely to their Moorish predecessors the knack of producing almost infinite variations upon a very simple theme, with the simplest of materials. They seemed never at a loss for a strictly decorative treatment of a plain brick wall, and succeeded in clothing the most commonplace surfaces with interest and variety, using only the single unit brick, which they were able to work into forms and fancies which would be the despair of a modern bricklayer, all the while, however, keeping strictly to a fine appreciation of fitness in both detail, design, and medium. It seems like a contradiction to ascribe color qualities to a construction executed in a single hue; and yet if it be remembered that architecturally color does not mean mere paint, that the color sense may manifest itself in the quality of light and shade, in the harmony of shadow and surface, in the nice balance of relief, and in the appreciative allotment of tone emphasis, these rusty old brick towers assume a color value which appeals very vividly to the artist; though like many other works in which architecture and the imagination are blended, in order to be truly appreciated for their tone qualities, they must be seen in place, with the blue sky and the scorching Spanish sunlight above, and the deep purple, green, and blue shadows flickering like jewels over the dull, tawny surfaces.

There are two other buildings in Saragossa of a different type, which are hardly less interesting. The structure known as the Lonja, or Exchange (illustration of this was shown in our April number), was erected in 1541. It is constructed entirely of brick with the exception of the cornice, which is of wood. The design is exceedingly dignified, well balanced, and appropriate. The propor-



CASTILLO DE LA MOTA.

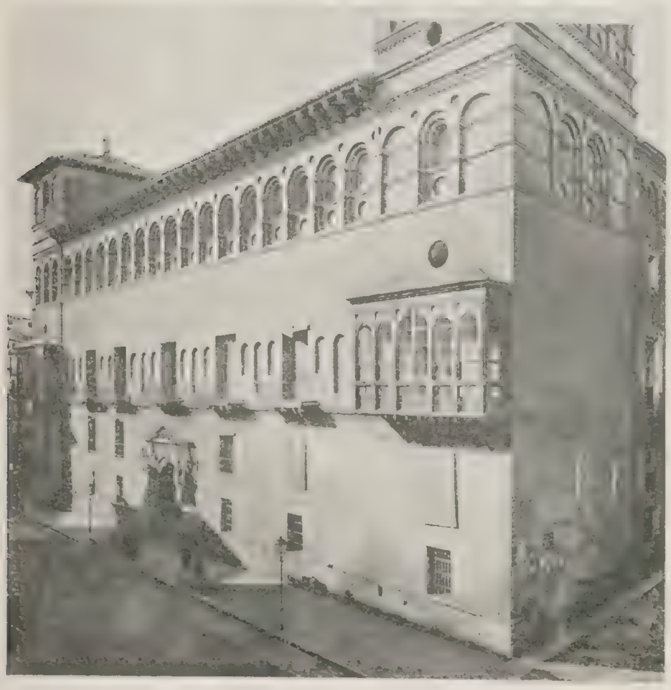


LEANING TOWER, SARAGOSSA.

tioning of the masses, especially the upper arcade of windows, is very satisfactory, and the cornice, though not strictly within the scope of this notice, is so admirably fitted to the general design that it must be considered as the equivalent of terra-cotta work. The Spanish architects, with a few notable exceptions, cared very little for fitness in the choice of material; form, color, mass, and proportion counted for everything, and whether a design was carried out in brick, stone, or wood was a matter purely of constructive or pecuniary detail with them. Consequently we find many buildings which, according to our present standpoints, are strongly suggestive of brick and terra-cotta work, whereas they are really constructed of stone, and, in some instances, as in the Lonja, wood was used probably for reasons of economy, but the spirit of the design is altogether that of terra-cotta work.

A similar structure is the ancient palace which is now occupied by the representatives of the government, the Real Audiencia. This is only in part of brick; the lower portion is of stone; but the more interesting portion of the design is constructed after the style of the Lonja. The older building is essentially Roman in style; that is to say, the general appearance of the structure, especially the cornice and the upper row of windows, recalls the structures which the Romans left as traces of their progress in various parts of Europe. The motive of the upper portion of the Audiencia, on the other hand, is essentially Spanish, namely, a short, square tower at each end of the building, denominating, but continuing the lines of a long arcade.

(*To be continued.*)



REAL AUDIENCIA, SARAGOSSA.

ARCHITECTURAL TERRA-COTTA.

BY THOMAS CUSACK. — (*Continued.*)

As a direct consequence of Mr. Sharpe's success with his first venture in the manipulation of fire-clay to meet the requirements of Gothic architecture at Lever Bridge, he was soon afterwards requested to duplicate it, but on a larger scale. This he did in a church built in the township of Rusholme, now part of the city of Manchester, and of it we cannot do better than quote his own description: "The plan that I adopted for this church was of more medieval type than that of Lever Bridge, determined as I was to prove that, even in these comparatively parsimonious days, it was possible to reproduce, in this ductile material, a genuine example of the true Lincolnshire type of the fourteenth century, without stint as to the nature of the molded and carved work with which its main features should be clothed. It has clustered piers, floriated pier capitals, and molded pier arches. It has a large five-light east window of flowing tracery, a diapered parapet to the aisle and clearstory walls, and a tower and spire 170 ft. high. The whole of the exterior is of terra-cotta, the coursed walling being of 5 in. blocks, as at Lever Bridge."

Many years after this (in 1874), having, in the meantime, retired from active practise, he was the principal contributor to and the honorary architect of yet another church, erected near his own residence at Scotforth. His faith in the use of terra-cotta remained unshaken, and, for the third time, he adopted it in the building of this, and, we regret to add, his last church. This time, however, he reverted to an earlier style — that of the transitional period towards the end of the twelfth century, when from the lighter examples of Norman, the first suggestions of early English were being evolved. This serves to show what a practical insight he had obtained into the true character of the material which he proposed to use. For, notwithstanding the undoubted mastery which in recent years has been gained in every process of its manufacture, this is in some respects, and perhaps above all others, the style best adapted to a free use of molded and oft-repeated forms, whether looked at from an architectural or from a purely economic point of view.*

The experience which he had already gained, and for which he had no doubt paid the usual high price, was turned to profitable account in the work of the second and third churches. Roundabout methods were discarded, and such errors of judgment as had been committed were, let us hope, not again repeated. Having outlined his design, he set about detailing it, and that done, he himself made the working drawings to shrinkage scale. In this case he jointed his work in much smaller pieces, and so arranged the joints that they would become an integral and by no means undesirable feature of the design. He had not been allowed to forget that he was using a refractory fire-clay, which, to be durable, had of necessity to be burned in an open fire, at a most intense heat, and the kiln sustained on full fire for several days. The comparatively small pieces — an average of 400 cu. ins. — into which he jointed his work enabled him to do this without incurring serious warping or distortion. This, in principle, was no doubt an improvement, but we think it was carried too far in the inordinately small blocks which he had fixed as a maximum. They were rather less than one sixtieth of the size which is now frequently made with perfect safety in drying and burning. Blocks containing 14 cu. ft. and weighing, when burned, 1,000 lbs., are not considered too large, provided they be anything like a convenient shape. We have seen pieces containing 17 cu. ft. turned out successfully, while blocks of from 7 to 10 cu. ft. are advantageous and indeed desirable sizes from a manufacturing standpoint, subject to the qualification already noted.

He did make one retrograde step, however, and though prompted by the best intentions, it was none the less a mistaken notion. With an aversion to shams that cannot be too highly commended in an architect, and should be prized by everybody, if only on account of its rarity, together with an unconquerable belief in absolute solidity that was truly British, he decided to make his blocks *solid* throughout. To use his own words, "The necessity for long and hard burning is diminished in proportion as you diminish the body of the clay, by hollowing out the back of the piece and render it to that extent less solid; but here we fall upon another evil almost greater than the first, for it is preeminently unsatisfactory to reduce the ornamental part, or show-side, so to speak, of that block to the condition of a shell, while honest stone or concrete does duty at the back as the real masonry of the building."

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*I hope to illustrate these churches at an early date. — T. C.

We have never been able to see much force in this as an argument, if argument it can be called. We contend that it is not at all a question of sheer solidity of the facing, in a literal sense, or of the solidity of the wall itself, for that matter, but rather the equation of strength, in the composite wall as a whole, built for a specific purpose and under well-considered conditions, irrespective of the number, thickness, or disposition of its components. Beyond this the craving for solidity is entirely one of sentiment, and may be reserved for purely academic uses. As well cavil at the hollow fireproofing, made purposely so for lightness, not calculated to support a concentrated load nor to resist the impact of artillery, but, like Mercutio's wound, "'tis enough, 'twill serve." We use common brick for backing stone and marble, and for building walls that are faced with bricks of a better quality. We accept the mosaics, the inlaid work, and the marble interiors of the Renaissance. But then, such instances as these would not have weighed with Mr. Sharpe — he was a Gothicist. At all events, his example in this particular has never been followed in anything larger than a brick, and even in it some makers stamp a recessed panel, which is valuable (if used) as a mortar bed. A "shell" the average thickness of which is 1½ ins., with cross partitions spaced on 6 in. centers, and honestly welded to the face and sides of the block, has met with a universal concensus of approval. This, as we have pointed out, admits of much larger pieces being made, reduces the otherwise enormous dead weight in the handling, facilitates drying in all its stages, allows the clay to be burned throughout its thickness to the point of vitrifaction, at a much lower temperature, without blowing or serious warping, and when *filled* solid with concrete, produces a block capable of supporting a pressure of 6,000 lbs. per square inch. But the filling in — that is the question, and of it more anon.

NATURAL HISTORY MUSEUM, LONDON.

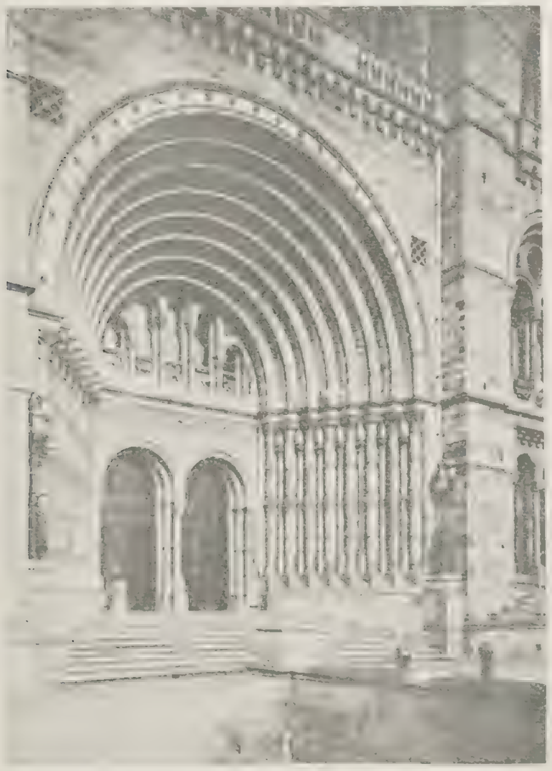
The late Captain Fowke was amongst the first to follow the lead of Mr. Sharpe, in an extensive though not altogether judicious use of terra-cotta, at the Museum buildings, Exhibition Road, South Kensington. Then came General Scott, R. E., assisted by Gilbert Redgrave in the erection of the great Albert Hall near by, in which all the main features are executed in this material, including the very effective frieze around the rotunda, which was designed by Edward J. Poynter, R. A. This will recall a similar treatment adopted by General Meigs in the battle scenes and military panorama on the Pension Office, Washington. Mr. Charles Barry also became a convert to and a strenuous advocate of its use, and gave reason for the faith that was in him by adopting it at Dulwich College.

These were noteworthy undertakings, and though in all of them there remained something to be desired architecturally, and much more on the manufacturer's part, yet the shortcomings revealed in them were obviously not insurmountable. They in turn were subjected to keen professional criticism, which, if it did no other good, gave rise to further thought and a fuller inquiry amongst architects. What was equally important, it forced the subject upon the attention of the building public. The general verdict was, on the whole, favorable to its use as a smoke and sulphur-resisting material, produced at reasonable cost, but susceptible of much improvement. Architects made some creditable attempts to adapt their designs to the exigencies of manufacture, and manufacturers in turn hastened to adopt improved methods of production, all of which were based upon a candid enough avowal of existing defects. That *chef-d'œuvre* — the Natural History Museum — that followed was the highly encouraging result of this reciprocal movement.

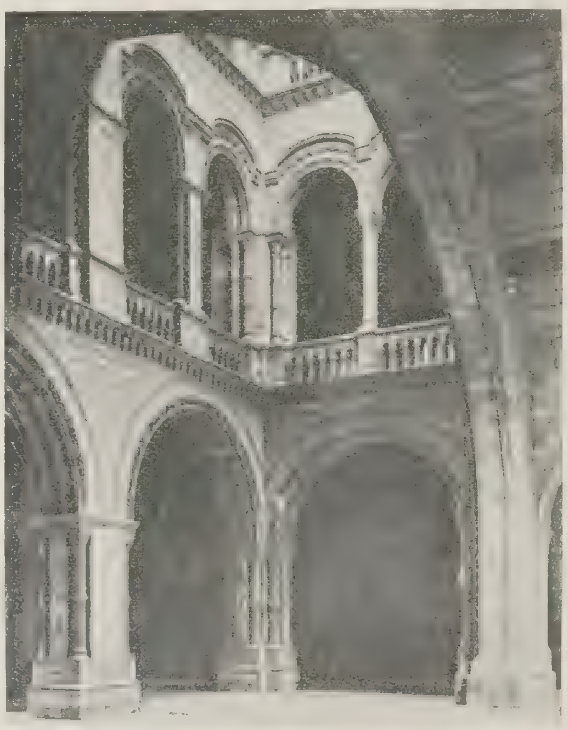
Architecturally considered, this great edifice added new honors to the long list of those already well won and as modestly worn by Alfred Waterhouse, R. A., whose fertile but well-balanced brain has enriched the Victorian era with so many creations of real beauty, obtained in all cases without any sacrifice of their utility. Being a work of national importance, the material to be used was from its first inception a vital question; and the one finally agreed upon was accepted as the result of very mature consideration. It had won the stamp of approval from an architect of the highest eminence, and a man in whose judgment the public had already learned to repose implicit confidence. These were a sufficient passport to popular favor, and so reassuring that even the icy conservatism of his professional brethren began to melt under their influence. The merit of the material, as well as of the building, when completed in 1878, could not be gainsaid, and the most skeptical among the fraternity were furnished with an orthodox precedent for its employment. It was seen to possess immediate worth and unlimited possibilities, and from that time onward it received more respectful consideration, until at length accorded its rightful place in the specifications of a vast majority of architects.

In point of style and general treatment we would take leave to define this building as Waterhouse Normanesque, a term that has not yet found a place in the glossaries, but it is the only one that to our mind conveys an exact idea of its main characteristics. It is erected on the site of the exhibition of 1862, has a frontage of 172 ft. on Cromwell Road, from which fashionable thoroughfare it stands back about 100 ft. The whole of the exterior is terra-cotta in two colors, buff and gray, no bricks appearing save in the internal courts for light and air. The same applies to the interior and all the galleries, where these two colors are agreeably blended without once producing a pattern that is garish or aggressive. In the mere display of ornament this building is not as costly as the British purse could buy. It is "rich, not gaudy." The subjects are well chosen, possess undoubted artistic merit, and are distributed with thoughtful discrimination. We say this in passing for the benefit of those whom it may concern, notably, some of our own exuberant "designers" of detail, who cannot refrain from putting in all they know, and perhaps a little more. In stone, the vital question of cost exercises a wholesome restraint upon their youthful, not to say effeminate, weakness for over-ornamentation. But they will revel in the plasticity of burned clay, until every inch of surface is bedizened with easily repeated forms, and the tired optic as a last resource seeks relief in the prevailing monotony, and rest in utter forgetfulness of the whole affair. In a similar building, intended for other purposes, the ornament would, no doubt, have been governed by Norman, or late Romanesque precedents, as it has been in the case of purely architectural forms. But in a natural history museum it is becomingly naturalesque, extinct and actual life being the two sources from which it was drawn. It has been conventionalized in part and to some extent, but so deftly has this been done, that one is at first sight beguiled into a comparison between the creatures of sea and land, placed in the cases, and those more enduringly depicted on the walls of the building. The monkeys that climb up the piers and salient angles with so firm a clutch suggest the presence of once living wearers of the prehensile tail, placed on exhibition, but the work of the modeler does not everywhere enter into competition with that of the taxidermist.

In the matter of construction, the blocks of terra-cotta are solidly built, with alternate long and short bond, similar in all respects to the best masonry. In this, as in a good many other things, it is in strong contrast to our growing tendency to veneer, without any bond whatever, save that "weak invention of the enemy" called wire bond, reinforced by occasional alleged anchors, inserted at the option of a more or less worthy body of men known as "lumpers," to whom the labor is usually sublet by a middleman, who calls himself general contractor. In the work under notice, every block was soaked in a tank of clean water, which served a double purpose; first, the natural suction being thus neutralized, sufficient moisture is allowed to remain in the cement while setting and during the process of crystallization. Second, the vacuum that nature abhors, but which must for a time exist in work that has passed through 2,000 degs. Fahr., being filled with *clean* water, there is no room left for absorption of the impure and discolored water from the mortar to stain the surface of the work, perhaps permanently, and certain to promote temporary vegetation. The chambers were all filled solid with concrete before being hoisted, so that the men on top had no option but to set them true on a good mortar bed, filling the vertical joints and grouting all interstices at every course. Not only was this specified; what was far more to the purpose, experienced and trustworthy representatives of the architect were in constant attendance to see that what was on paper was duly carried out in letter and in spirit during all stages of the work. Our plan of building in hollow boxes, or, at best, making a pretense of pushing in a few bricks when backing up, setting the work so close that no room is left for any mortar in the vertical joints except a lick and a promise, smeared on the outer edges, pointing up for the sake of appearance, and then, of course, "going ahead," can hardly be claimed as an improvement. The work itself, as made by our best firms, is quite as true to line, as well modeled, as accurately fitted — and this we say advisedly — of far more even color, than any yet made in England. As a general rule, however, it suffers, and that most lamentably, in the setting. The manufacturers, and such of their men as take any real pride in their work, look on in dismay and indulge in various forms of regret, all of which are in vain; but beyond this they have little, if any, control under present anomalous conditions. We have data, enough and to spare, for these statements, but should any one suffering from a good fitting cap think that such "comparisons are odious," we reply that they ought to be edifying. In words from the same undisputed master of English, they may "pardon what I have spoke, for 'tis a studied, not a passing thought, by duty ruminated."



ENTRANCE NATURAL HISTORY MUSEUM, LONDON.



VIEW OF INDEX MUSEUM, NATURAL HISTORY MUSEUM, LONDON.

Taken for all in all, this one building in not only the most homogeneous, but by far the most complete and satisfactory example of purely architectural terra-cotta that any age or nation has yet produced. Granted the exceptional opportunities placed at the architect's disposal in the way of magnitude and financial means. Similar conditions have existed more than once during the last quarter of a century, and though the mountain labored and brought forth something bigger than a mouse, in no case has the outcome been worthy of comparison. Alfred Waterhouse alone was fully equal to the occasion, and his work stands to-day an unrivaled masterpiece. Twenty years have elapsed since his conception became realized. It is but one of the many projects of equal and even greater magnitude conceived and executed during the years of his prime, and by which he had ere then achieved a national reputation. On it, but not upon it alone, he bestowed the best efforts of a mind ripe in experience.

Since that time he has grown in honors, as in years, yet found no reason to recant his earlier conclusions, or to regret his choice in the use made of this material. On the contrary, he has never ceased to urge its many claims to acceptance, and never once neglected a suitable opportunity to lead the way in its continued use. Therefore, if not the father of modern terra-cotta throughout the English-speaking world, he has been to it a potent and unflinching godfather, and as such we would respectfully salute him.

(*To be continued.*)

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

FIRE-PROOF FLOOR ARCHES.

BY GEO. HILL, C. E. (*Continued.*)

CLAY ARCH TESTS.

Test No. 84.— This was of an end-construction arch similar to Test No. 83, and shown in Fig. 35. At 5,000 lbs. cracks appeared at the bottom on the right-hand side of the key. At 10,000 lbs. these cracks opened ⅛ in.; the top surface bulged up. At 12,500 lbs. the cracks at the bottom of the key opened ¼ in.; cracks appeared between the skew-back block and the skew-back beam along the left-hand end, and a crack also appeared along the left-hand end in the skew and the first voussoir just above the bottom fillet of the web of the skew-back beam, as shown in Fig. 42. This skew then crushed off over the whole bottom, and the facing plaster dropped off from the top. The maximum load was 13,000 lbs. The key was cracked along the top cover plate, and the skew was a splintered mass.

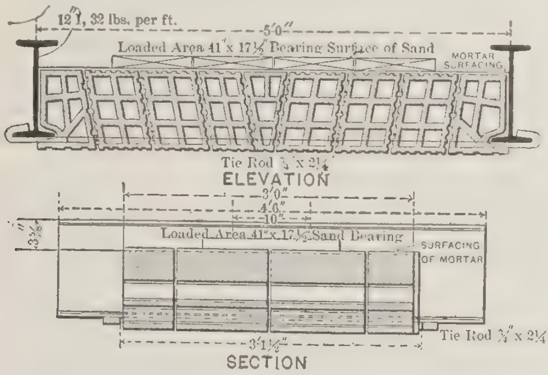


FIG. 36.

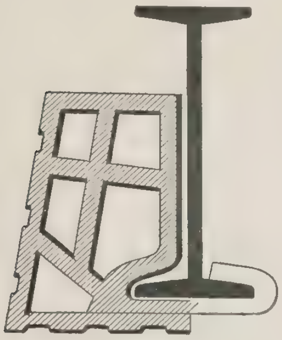


FIG. 37.

Test No. 85.— This was of a side-construction arch of the section shown in Fig. 36, with the load applied over an area of 41 by 17½ ins. The effective depth of the arch was 7½ ins., and there was a leveling of mortar on the top. The key course was quite high in the center, so that the load was applied almost directly on it. The course next west of it was also a little high. At 5,000 lbs. a crack opened at the bottom of the key on the left-hand side about $\frac{1}{16}$ in. At 10,000 lbs. failure occurred at the top of the voussoir, the third one from the left-hand skew-back, or the second one from the key. All through that course there was a crushing of the top web. The flange protection of the skew-back also sheared off.

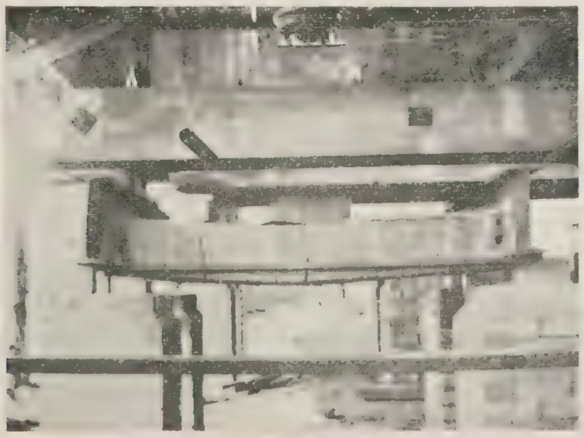


FIG. 41.

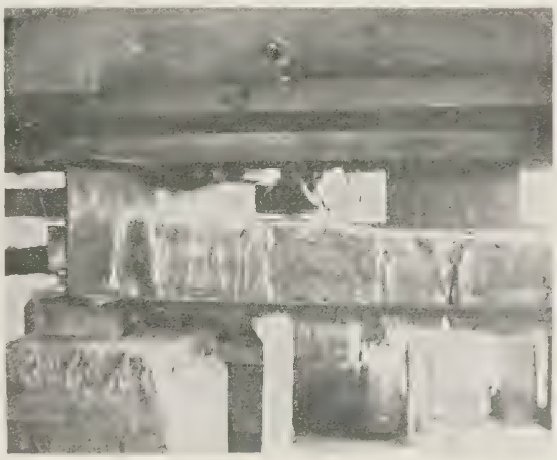


FIG. 42.

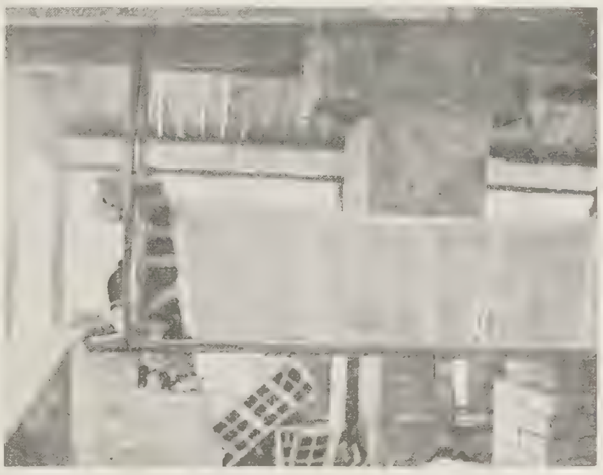


FIG. 43.

Test No. 86.— This was of a side-construction arch with a similar loading, namely, 17½ by 41 ins. The skew-back of this arch is shown in Fig. 37, the remaining details are indicated in Fig. 36. At

FIG. 44.

5,000 lbs. a crack appeared on the left-hand side of the key at the bottom, and at 12,500 lbs. the top cover began to break up, while failure occurred at 14,500 lbs., the web along the voussoirs next to the skew-backs at the left-hand end shearing all across and directly down. The effective rise of this arch was 8 ins.

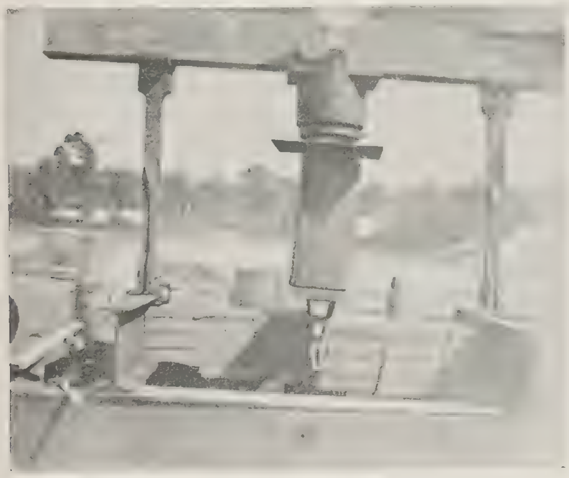


FIG. 45.

Test No. 87.— This was of an end-construction arch nominally 12 ins. deep, having an effective rise of 10 ins., and with a side-construction skew-back of hard tile, shown in Fig. 43. At 3,750 lbs., reached in one minute, a hair crack appeared on the right hand side of the key, and showed through to the other face. At 7,500 lbs., reached in 2.5 minutes, the skew-back began to show failure at both sides. At 10,000 lbs. no change took place. At 11,250 lbs. reached in 4 minutes, the arch again began to fail at the skew-backs, and the crack next to the key at the bottom opened $\frac{1}{16}$ in. At 15,000 lbs., reached in 13.2 minutes, the cracks showed all along the skew-back joints on both sides. At 16,400 lbs., reached in 14.3 minutes, the arch failed, the top surface cracking, a slight crack appearing in the top cover of the key, and the skews cracking off just below the diagonally inclined piece on both sides, the bottom cover piece falling off (Fig. 43).

Test No. 88.— This was of an end-construction arch, similar to that shown in Fig. 35, except the skew-backs, which are shown in Fig. 41, and were of the porous terra-cotta solid type; the effective rise was 7 ins., and there was a slight finish of mortar on top. The load was applied on an area of 10 by 13 ins. At 2,500 lbs., after 1 minute loading, a hair crack appeared on the right-hand side of the bottom key. At 5,000 lbs., after 1.5 minutes, a crack appeared on the east skew-back by the block moving away from its beam; at 6,500 lbs., after 2 minutes, the crack at the bottom of the key widened to $\frac{1}{16}$ in.; at 7,250 lbs., after 2.3 minutes, the left-hand skew-back cracked on the top away from the first voussoir; at 8,000 lbs. the same thing happened with the right-hand skew; at 9,000 lbs. after 3 minutes, the cement cover on top of the key began to rise away from the surface. At 10,000 lbs. this began to crack over the top of the key; at 12,000 lbs. the left-hand skew-back began to crack where the lower hole went through it. At 12,500 lbs. the top surface on the key cracked very badly, and the cracks at the skew-backs opened ¼ in. each. At 13,500 lbs., after 5.5 minutes, the key at the bottom cracked open ¾ in. and the bottom plaster began to fall out, and at failure the point of the left-hand skew sheared off, the key cracked through the middle, near the top section opening about ½

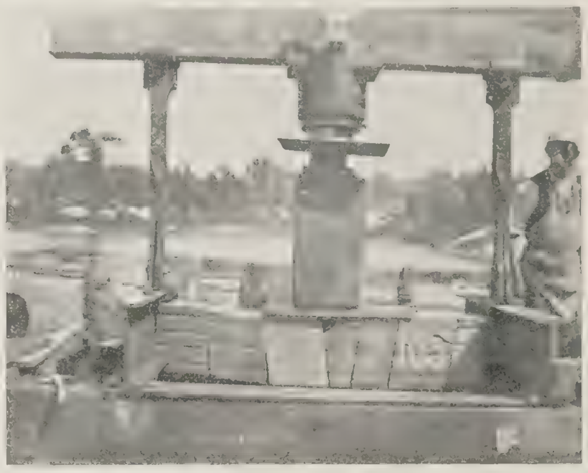


FIG. 46.

TABLE NO. 4.— DATA OF CLAY ARCH TESTS.

Test Number.	Span. Inches.	Rise. Inches.	Width. Inches.	Total Arch Area. Square Feet.	Loaded Arch Area. Square Feet.	Total Load. Pounds.	Load per Square Foot of Arch. Pounds.	Load per Square Foot Loaded. Pounds.	Area Tie-rod. Square Inches.	Horizontal Thrust. Pounds.	Shear per Foot Skew. Pounds.	Depth of Skew. Inches.	BLOCKS.			LOAD.	REMARKS.
													Style.	Material.	Skew.		
76	46	5	11.5	3.67	2.88	9 000	2 455	3 125	1.57	10 340	4 670	7.5	End	Hard.......	Protection	Distributed.	Failed on arch lines.
77	46	5.5	11.5	3.67	2.88	2 500	682	868	1.57	2 615	1 303	8	Side	Hard.......	Protection	Distributed.	Sheared. Laid dry.
78	45	5	11.5	3.62	2.88	1 300	359	452	1.57	1 464	678	8	Side	Hard.....	Protection	Distributed.	Sheared. Laid dry.
79	60	3.5	48	20.00	3.00	13 750	688	4 590	1.57	29 500	1 720	6	End	Hard.......	Protection	Distributed.	Crushed on arch lines. Old arch in Portland cement.
80	65	6	50	22.6	20	57 500	2 545	2 875	3.52	78 000	6 980	10	End	Hard.......	Plain.....	Distributed.	Unbroken. Laid in Portland and frozen.
81	60	6	36	15	0.82	10 000	668	12 200	3.38	25 000	1 670	8	Side	Hard.......	Plain.....	Center......	Sheared by edge of load. Portland.
82	60	5	36	15	4.98	5 700	381	1 143	3.38	8 550	950	8	Side	Hard.......	Protection	Distributed.	Sheared by skewback. Portland.
83	60	5	35.2	14.7	0.88	11 250	767	12 800	3.38	33 750	1 890	7.5	End	Hard.......	Protection	Center.... .	Crushed porous terra-cotta skew. Portland.
84	60	5	36.5	15.2	0.88	13 000	857	14 800	3.38	39 000	2 135	7.5	End	Porous T. C.	Protection	Center......	Crushed porous terra-cotta skew. Portland.
85	60	7.5	36	15	4.98	13 500	900	2 710	3.38	13 500	2 250	10	Side	Hard.... ..	Protection	Distributed.	Crushed on top by key. Portland.
86	60	8	37	15.4	4.98	14 500	943	2 915	3.38	13 600	2 360	10	Side	Hard.......	Plain.....	Distributed.	....
87	60	10	41	17.1	0.88	16 400	960	18 670	3.38	24 600	2 395	12	End	Hard	Plain....	Center......	Side skew. Skew failed. Portland.
88	60	7	38.25	15.8	0.88	14 500	919	16 500	3.38	31 100	2 290	8	End	Porous T. C.	Plain.....	Center.....	Porous T. C. Skew. Portland.
89	60	7	38.25	15.8	0.88	15 750	997	17 000	10.14	33 800	2 480	8	End	Hard.......	Plain.....	Center......	Porous T. C. Skew.
90	60	8.75	10	4.2	0.82	3 100	739	3 780	10.14	5 320	1 890	12	End	Hard.......	Protection	Center......	End skew, side key. No mortar.
91	60	9	10	4.2	0.82	5 000	1 190	6 100	10.14	8 350	3 050	12	End	Hard	Protection	Center.... .	All end. No mortar.
92	60	5	12	5	1.00	3 500	654	3 500	10.14	10 500	1 750	8	Side	Hard.......	Protection	Distributed.	No mortar.
93	60	5.5	12	5	4.0	10 000	2 000	2 500	10.14	13 640	5 000	8	Side	Hard.......	Plain.....	Distributed.	No mortar.
94	60	9	10	4.16	3.35	15 100	3 630	4 510	10.14	12 560	9 210	12	End	Hard.......	Protection	Distributed.	Deflection 1½ inches by crushing in. No mortar.
95	60	9.5	10	4.16	1.00	2 500	601	2 500	10.14	3 950	1 525	12	End	Hard.......	Protection	Center......	....
96	60	9.5	10	4.16	1.00	3 000	723	3 000	10.14	3 980	2 400	12	End	Hard.......	Protection	Eccentric...	18 inches from W. skew-back beam. No mortar.
97	60	5.5	12	5.0	1.00	1 500	300	1 500	10.14	3 440	1 750	8	Side	Hard.......	Plain.....	Eccentric...	18 inches from W. skew-back beam. No mortar.
98	60	5.5	12	5.00	1.00	2 500	500	2 500	10.14	6 850	1 250	8	Side	Hard.......	Plain.....	Center......	....
99	60	5.5	24	10	6.00	9 950	995	1 658	10.14	22 650	2 486	8	Side	Hard..... .	Plain.....	Distributed.	Two blocks wide. No mortar.
100	60	5.5	24	10	2	2 500	250	1 250	10.14	6 820	625	8	Side	Hard..	Plain.....	Center......	Two blocks wide. No mortar.
101	60	5.5	24	10	2	2 750	275	1 375	10.14	7 190	1 100	8	Side	Hard.......	Plain.....	Eccentric...	Two blocks wide. 18 inches from W. beam. No mortar.

in., and near the bottom section a crack opened that was just perceptible.

Test No. 89. — This arch was similar to the last. At 2,250 lbs. a crack opened on the right-hand side of the bottom key; at 10,000 lbs. this crack opened $\frac{3}{32}$ in.; the top surface of mortar began to spall up. Cracks appeared between the skew and the first voussoir on the left-hand side. At 13,000 lbs. the crack in the bottom of the key opened ⅛ in., and the cement cover began rising on top in the center. At 15,000 lbs., after four minutes, the crack at the center began to spall, the plaster began falling off at the bottom, and the key began to splinter. When failure occurred the arch was all splintered on the top, and when the top was taken off it was found to have cracked along the line of the arch thrust. The maximum load was 15,750 lbs. The left-hand skew cracked between the two holes, shearing out and dropping off. The first voussoir from the right-hand skew had the bottom plate sheared off entirely, all of the cracks showing the true arch action.

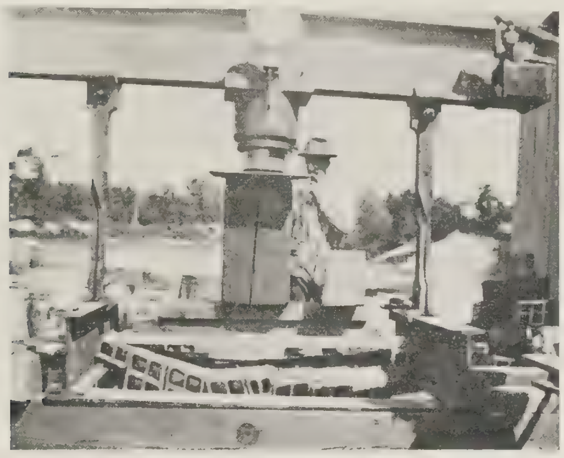


FIG. 47.

All of the following tests were made with hard tile arches laid up without any mortar. A little damp sand was used to bed the skew-backs of the side-construction arches and to even up the top for the first plank. They were all built between the same pair of beams and usually sagged a little after the center was struck.

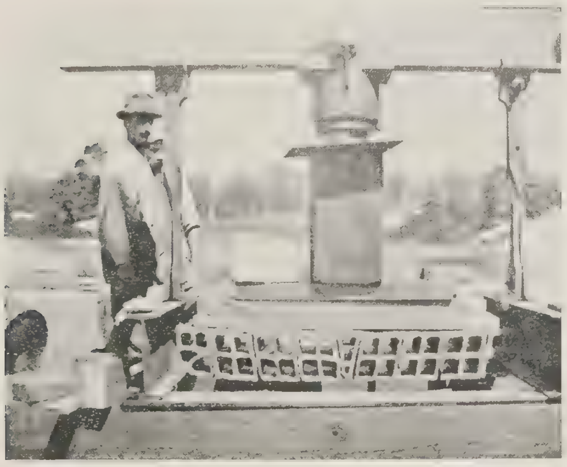


FIG. 48.

Test No. 90. — This was of a hard tile end-construction arch, with a side-construction key, the load being placed as shown in Fig. 44, on the top of the key. Immediately on the loading being started, there was a pinching in of the key and cracking at the point where the top of the voussoirs struck it; but the key section of ¾ in. material stood under the vertical load until a maximum of 3,100 lbs. was reached after 2.2 minutes. Data concerning this arch is given in Table No. 4. After failure the arch looked as in Fig. 45.

Test No. 91. — This arch was 12 in. end-construction protection-skew hard tile; the key block had the corners chipped out as shown in Fig. 46; the left skew was the only one that failed; the right-hand voussoir, which had the numbering on, cracked on top as shown. The maximum load of 5,000 lbs. was reached in 2.2 minutes.

Test No. 92.— This arch was of the side-construction protection-skew hard tile block type, and failed under a distributed load made as shown in Fig. 47, which also shows the manner of the failure. The only block which failed was the left-hand skew, which sheared off by reason of the thrust of the diagonal piece, not being supported by the flange of the beam. The maximum pressure in this case, 3,500 lbs., was reached in 4 minutes.

Test No. 93.— This arch was built of the same voussoir blocks as Test No. 92, with a new key block and with plain skew-backs, as shown in Fig. 48. The result was that the arch carried a load of 10,000 lbs., and, when failure occurred, the left-hand skew broke all to pieces.

Test No. 94.— This arch was of the 12 in. end-construction hard tile protection-skew type, loaded over 10 minutes, and maximum being reached at 4.5 minutes; the crown deflected about 1½ ins., due to the crushing in of the material. At the beginning the joint at the bottom of the key was open ¾ in. On the side opposite to that shown in Fig. 49, it was practically intact, and, at the time the photograph was taken from which the cut was made, the arch was carrying over 8,000 lbs.

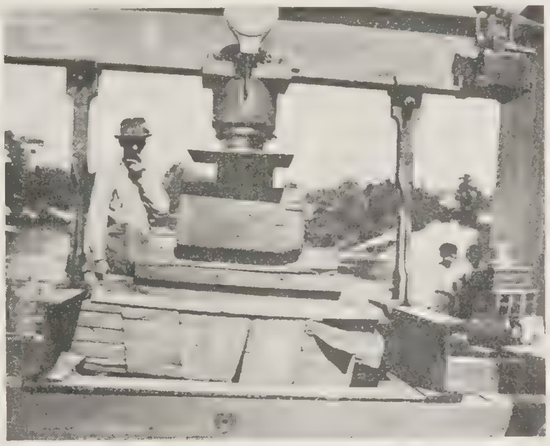


FIG. 49.

Test No. 95.— This was of a 12 in. end-construction hard tile arch, which began to spall on the top at 2,250 lbs.; the west or left-hand skew split at 2,500 lbs., and the voussoir at the right-hand side of the key split at the top. This arch is shown in Fig. 50 after failure.

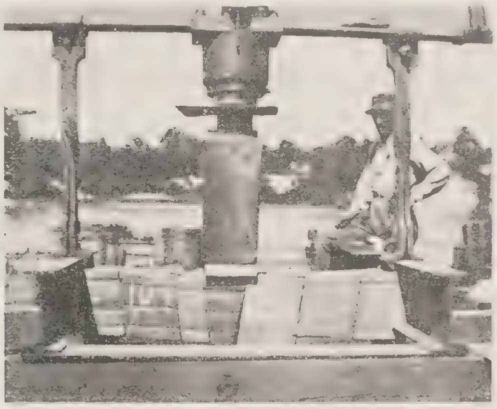


FIG. 50.

(*To be continued.*)

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VI. (*Concluded.*)

THE CHEMISTRY OF CEMENTS.

IT will be observed that, in the matter of proportions, this cement was as nearly perfect as it was possible to be made. It was tested frequently by the author for many years, and it was never known to check or expand, and it became exceedingly hard and permanent in masonry, and was used in sidewalks and similar work, almost to the exclusion of all other brands, and yet it would rarely exceed 250 lbs. in a seven days' test. Neither did it become glassy and brittle with age, like the modern Portland cements, a result due entirely to the demand for higher short time tests; a demand which, to the detriment of its quality, has compelled the manufacturers of the brand in question to increase the proportion of lime, as may be seen by reference to No. 10 of the table of analyses, in which it will be observed that the ratio of silica to lime is as 1 to 3.07, while the ratio in the earlier analysis as herein given is 1 to 1.85+, which is practically the true combining ratio, *i. e.*, 1 to 1.86+.

The new ratio which is sought to be established is best shown by the formula $3CaO.SiO_2$, while that for the long accepted ratio is $2CaO.SiO_2$. These two formulas, reduced to percentages, are given in the order named.

Silica	26.38	Silica	34.91
Lime	73.62	Lime	65.09
Totals . .	100.00		100.00

There is no simpler way to demonstrate by practical experiment which of the two formulas comes the nearest to actual facts, than by mixing together clay and gypsum, with the latter in excess, and calcining to a white heat. The amount of sulphate of lime remaining will determine the amount of lime that has combined with a given amount of silica.

Such experiments made under the direction of the author demonstrated very clearly that the correct ratio is not in accord with the modern theory that 3 molecules of lime combine with 1 of silica.

It is well known that if we calcine 100 pounds of gypsum to a white heat, the only change which is effected is the expulsion of the water of crystallization, amounting to 20.93 per cent. of the total weight, leaving 79.07 sulphate of lime, which is composed of lime 32.55 and sulphuric acid 46.52.

If, however, the 100 pounds of pure gypsum are finely ground and thoroughly mixed with 23.27 pounds of dry clay, composed of silica 17.45 and alumina 5.82 = 23.27 clay, the composition in hundred parts will be as follows: —

Sulphuric acid	37.74	
Lime	26.40	= 81.12 gypsum.
Water	16.98	
Silica	14.15	
Alumina	4.73	
Total	100.00	

If this mixture is then calcined to a white heat, the water of the gypsum will first be expelled, and when the high heat is reached, the silicic acid will expel the sulphuric acid and itself combine with the lime and alumina, forming an hydraulic cement pure and simple, the analysis of which will appear in column No. 1 of the following table, the succeeding columns exhibiting the amount and kind of silicates contained therein.

No.	1	2	3	4	5
Silica	31.25	— 18.44	= 12.81	— 12.81	= 00.00
Lime	58.30	— 34.39	= 23.91	— 23.88	= 00.03
Alumina	10.45	— 10.45	= 00.00	— 00.00	= 00.00
Totals	100.00	63.28		36.69	00.03

Silicate of lime and alumina	63.28	
Silicate of lime	36.69	
Total silicates		99.97
Total free base		0.03
Total		100.00

It will here be seen that, the silica being present in full combining proportions with the lime, the sulphuric acid was all expelled. Whereas, had there been an excess of lime, it would have retained its equivalent of sulphuric acid in combination as sulphate of lime.

Now if we deduct 4 from the silica, thus leaving the lime in excess, the analysis before calcination would appear as in the following table.

Sulphuric Acid	39.00	
Lime	27.29	= 83.84 gypsum.
Water	17.55	
Silica	11.28	
Alumina	4.88	
Total	100.00	

After calcination at white heat, the analysis, reduced to hundreds, will appear as shown in column No. 1. of the following table, the succeeding columns showing the kind and amount of silicates and sulphates in the cement.

No.	1	2	3	4	5
Sulphuric Acid	17.10	. . . .	. . . .	. . . .	17.10
Lime	52.07	— 30.64	= 21.43	— 9.48	= 11.95
Silica	21.52	— 16.43	= 5.09	— 5.09	= 0.00
Alumina	9.31	— 9.31	= 0.00	— 0.00	= 0.00
Totals	100.00	56.38		14.57	29.05

Silicate of lime and alumina	56.38	
Silicate of lime	14.57	
Total silicates		70.95
Sulphate of lime		29.05
Total		100.00

Since the days when it became the rule to add an excess of lime for the purposes stated, there have been no artificial cements produced which do not become brittle and glassy with age.

While such a cement is being used, and while under the eye of the engineer, and until the work is finished and has passed inspection, and an occasional examination thereafter, it seems to have acted in a most admirable and satisfactory manner. It has set hard, as was expected, and the matter soon becomes ancient history with the engineer or architect, whose attention is required by things present. And yet this cement is not laid away as though dead. It is not by any means inactive.

Its crystallization is rapid, as evidenced by its prompt induration, and it is this rapid crystallization which inevitably results in rendering the mortar brittle, and thereby liable to subsequent disintegration, a result which does not follow in the use of well-balanced American rock cements, which, although they do not in the earlier days subsequent to their use exhibit the hardness common with the artificial cements, nevertheless, at a later period, they reach the same degree of solidity, and exhibit a toughness and tenacity of cohesion unknown among the modern artificial cements.

(*To be continued.*)

CONSUMPTION OF PORTLAND CEMENT IN AMERICA.

IN the April number of THE BRICKBUILDER appears a paper by Wm. G. Hartranft, in which it is argued that the increased use of American Portland cement is not due to the lower price at which it is sold, as intimated in the "Mineral Resources of the United States" for 1894, but rather to the superiority of American Portland cement over that of foreign manufacture.

As the author of the report in the "Mineral Resources" to which objection is made, the writer feels called upon to add a few words in justification of the position at first taken. The only part of the report referring to the relative prices of American and foreign Portland cement is the sentence: "Good American Portland is to be had at 50 cents to $1.00 per barrel less than the best German, and is being extensively adopted for large government and private contracts." This statement refers to retail price of cement delivered on the work, and, as Mr. Hartranft says, applies especially to the trade at interior points. This statement was also made more than a year ago, and since that time the reputation and relative price of American Portland cement have gained to a surprising extent. The prejudice against the American product is rapidly disappearing, and among educated engineers the American and foreign cements compete on fair and equal terms, on the basis of price and quality. The writer has made hundreds of careful tests, during the past few years, of American and foreign cements, and has seen the records of such tests at the offices of city and government engineers at various points. The results show, beyond question, that no cement made in any foreign country shows as high tests, at short or long periods, as that produced at three or four of the leading American factories.

It is also true that American cement has very largely replaced the foreign cements throughout the country. This is especially true of the English and Belgian cements, which are generally considered inferior to the best German. There is no difficulty whatever, at present, in selling a good American Portland in St. Louis or Chicago at a higher price than the well-known brands of English cement. Nevertheless, the fact remains that there is among contractors and sidewalk men a great prejudice in favor of certain brands of German cement, and that the latter still command, in consequence, a higher price than the American. This prejudice is unfounded, and, therefore, certain to disappear in time, but it still exists.

Further, American cements can be profitably made at a price which allows them to be sold cheaper than the best imported German, and where the two come into competition on large contracts, the award is generally made to the American manufacturer on the basis of price. This was clearly shown on the occasion of the letting of a large government contract for cement, at Pittsburgh, last winter. The offers were as follows: —

1 Belgian cement	$2.55	per bbl.
5 German cements, average price . . .	2.66	,, ,,
4 American cements, average price . . .	2.28	,, ,,

The award was made to one of the companies manufacturing at Coplay, Pennsylvania, to which Mr. Hartranft especially refers as commanding a high figure in Eastern markets, *at the price of $1.99 per barrel.* It does not, therefore, appear that the underselling of the foreign cements is confined to "some of the small Western mills located at interior points," as suggested by Mr. Hartranft.

The fact is that the price of Portland cement is steadily coming down, and the fall is being greatly hastened by the successful competition of American against foreign manufacturers. There can be no doubt that within a very few years practically all the Portland cement consumed in this country will be of domestic manufacture. The prices of cement, however, will hardly be the same then as they are now. When the demand is fully supplied by American factories, we shall have in this country works producing 2,000 barrels or more of cement per day, as in Germany; and the same result will doubtless be reached here as has been reached in Germany, namely, the complete replacement of the common natural-rock cements by artificial Portland.

SPENCER B. NEWBERRY.

THE HARDENING OF CEMENTS.

SCARCELY any of the raw materials used in building operations is so liable to be deceiving as cement. It was only a short time ago that we called attention to this matter, and urged that some united action should be taken, with a view to obtaining some reliable data from which a standard should be evolved. We seem to be a good deal behind our American and German contemporaries, for their current scientific literature very frequently contains accounts of painstaking experimental work that is being carried out in this direction.

Amongst the latest of these are some experiments by Tommei, who has been endeavoring to investigate the mechanism of hardening, choosing as the substance for experiment, Portland cement. He appears to have subjected samples of set cement of known date to the action of certain chemical solutions, and thus to have estimated their resistance.

He concluded from his experiments that the process of hardening in cements involves the formation of silicates of increasing stability. He believes that the cement has an action upon the sand with which it is mixed — a theory which is in accord with the views of our English experts.

It was not thought sufficient to rely upon the evidence of chemistry alone, and to illustrate the thoroughness with which the investigation was conducted, we may state that microscopic observations were made of thin sections of set cement. These observations showed numerous transparent glassy particles, which were, without action on polarized light, embedded in the mass of cement. Tommei considers these to consist of colloidal silica.

When the age of the cement increases crystals become visible, together with crystalline plates showing double refraction; these are considered to be a consolidated form of the aforementioned colloidal silica.

Other tests were made, including an estimation of the heat evolved by the material during the process of setting. Slow-setting cement gave results which, in heat units, reached 9,331, whilst cement of the same brand, but of a quick-setting nature, gave 7,752. Probably the majority of our readers would have expected the results to have been the other way round.

The general conclusion, then, is that the character and amount of the sand present in a given sample of cement has a very pronounced influence upon its stability when set, and that we should so regulate the composition of the cement as to favor the formation of silicates of increasing stability, if we want to establish a good reputation amongst users; whilst users should only buy such cement as fulfils these conditions. — *British Clayworker.*

THE ADAMANT CEMENT COMPANY, Allentown, Penn., has been incorporated by William Andrews, Allentown, Penn., Joseph Bird, and John Sheetz, both of Philadelphia. Capital stock of the company is $100,000.

M. FRANCISCO YRARRAZAVAL, of Santiago, Chili, has been in this country investigating the American methods of manufacturing Portland cement. It is Mr. Yrarrazaval's intention to establish a cement-making plant on his large estate which is at Santiago.

THE STANDARD CONCRETE MANUFACTURING COMPANY, Camden, N. J., has been incorporated by Messrs. John Donaldson, Cyrus Borgner, and others. Capital stock, $100,000.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

FORMAL ESTIMATES.

IT is usually provided by law that all public work amounting in value to more than a certain specified sum, usually from one to five thousand dollars, shall be open to free competition, and that the work shall be awarded to the lowest bidder, provided he is a responsible party and files a bond as an assurance of his ability to execute the work in a satisfactory manner. Such provision, while protecting the interest of the contractor in many ways, notably in preventing undue favoritism, and, on the other hand, while it assures unlimited competition and consequently comparative low figures, which tend to give the public the largest return for their money, yet in many instances it works directly against the best interests of both the contractor and the people. In the building business, as in every other, there are different grades and standards of work, and a man who is fully competent to build a warehouse or mercantile structure, and finish it as well as the requirements demand, may be, and usually is, unfitted to do the higher class of work which would be called for, for instance, in a public library or court house. But as the law allows of no discrimination, the low grade man figures high grade work, the public get a corresponding return, and the contractors who figure to do such work as it should be done soon find their time is wasted in such competitions, and refuse to enter them. As a result of this, the field is left open to those who are incapable of doing work which is up to the required standard, for it must be said, notwithstanding all opinions to the contrary, no architect can make a contractor do better work than he is accustomed or paid to do. It seems as if a way might be devised through the associations of builders to overcome this difficulty, and to give the public in important work the services of those who stand highest in the building trades, a result which any one who has had experience in such matters, whether architect or contractor, cannot fail to desire.

A step in this direction has already been taken in Massachusetts, where some of the boards which have in charge the erection of department buildings have the power to select a certain number of contractors to estimate upon the work. In this way the work is figured by a limited number of builders, each of whom is responsible and competent, in which case the lowest bidder can be given the work without hesitation or delay. Although in all public work "the right is reserved to reject any or all bids," as a matter of fact, it is comparatively seldom that the work is given to any but the lowest bidder. If any discrimination is to be made, the way to do it is to limit the number of bidders, and until this can be done few of the abuses which now exist in connection with public work can be corrected.

Of course, in the case of private work, the selection of persons to estimate rests entirely with the owner and architect. And the latter usually makes a selection of some half dozen contractors whom he considers competent to execute the work in a satisfactory manner. As a rule, the owner defers to the judgment of his architect in such matters, but sometimes insists in having the building figured by some one whom the latter considers untrustworthy or incompetent. In such cases it is the duty of the architect to protest as strongly as possible, both on the ground of unfairness to himself as well as to the other contractors who are to compete for the work. Such a matter is of the utmost importance to the architect, for the person in question is usually the one most liable to be the lowest, and the architect is thus often forced to work with some one against whom he is prejudiced from the start, a condition which is practically sure to make friction and produce most unpleasant and unsatisfactory results.

Unless there are good reasons to the contrary, it is only fair to those who are to figure a given piece of work, to let it be known who are to estimate with them, so that if any one of the number feels it is useless to compete, he may withdraw, and not waste his time in estimating when he thinks he has no chance to obtain the contract.

(*To be continued.*)

LIME MORTAR IN FREEZING WEATHER.

THERE is a popular fallacy to which a great many masons adhere most tenaciously, that the addition of lime to cement mortar is desirable if the work is to be carried out in freezing weather. Upon what reasoning such a solution is based it is impossible to determine, though there seems to be a vague feeling that because the lime in slacking becomes very hot, it therefore must impart a certain portion of its heat to the mortar and so retard any effect of freezing weather. This is not only illogical, but it is not warranted by facts. Lime is slacked in cold water; it is then mixed with cold sand and cold cement, and is on ordinary building operations carried a long distance through the cold atmosphere, so that by the time it is actually laid up with the cold bricks in the cold wall all heat virtue has departed and the lime is absolutely inert in caloric. So much for theory. To determine the practical effect, tests were made last winter during the course of the construction of one of our largest buildings. Upon the coldest day of the winter, when the thermometer registered below zero, two 8 in. square brick piers were constructed under as nearly as possible the exact conditions which would obtain in a wall. The piers were a little over 1 ft. high. One was laid up with mortar composed of 1 part lime, 2 parts cement, and 4 parts sand. The mortar of the other was composed of 2 parts cement and 4 parts sand. The piers were allowed to stand under cover which would protect them from beating storms, but they were exposed to alternate freezing and thawing effects of the temperature during a period of about three months. At the end of that time it was found that the mortar containing lime was considerably disintegrated, so that it could be crumbled easily between the fingers, while the cement mortar, though somewhat injured by frost, was still reasonably firm and hard. The first pier was dropped to the floor through a distance of 4 or 5 ft. and was entirely destroyed, no bricks adhering to each other. Dropping the cement mortar pier through the same distance, it broke in two pieces, and not until it had been violently dashed against the floor six times was it entirely destroyed. Even then some of the bricks broke before the mortar became dislodged.

The reason for this action of the two mortars is very apparent. The addition of lime to cement mortar tends to retard the setting. Consequently there would be a considerable period during which the cold weather could act disastrously upon the mortar. Furthermore, lime mortar sets by absorbing carbonic acid from the air, a process which takes a great deal of time. Cement mortar, on the contrary, sets by crystallization, and a few moments after it is in place in the wall the outer surface has taken a sufficient set to serve as at least a slight protection against the cold, while long before the lime mortar mixture would be hard the cement mortar would be so completely crystallized that the cold would have comparatively little effect upon it. Consequently, the addition of lime to cement mortar is a positive detriment in every sense.

STANDING ARBITRATION COMMITTEES IN MASTER BUILDERS' EXCHANGES.

EDITOR BRICKBUILDER.

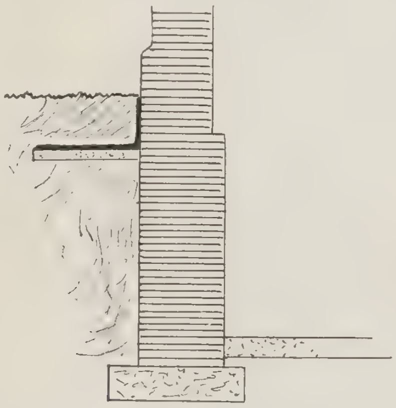
Dear Sir: — Nearly all contracts for building work include a proviso that in case of dispute between the contracting parties, the final settlement shall be left to referees under established conditions.

This clause is practically of little value for the reason that the party against whom the referee decides is very apt to appeal to law. May I be permitted to suggest a way by which, at least, some of the extended litigation might be obviated? The Boston Real Estate Exchange has a standing arbitration committee, and a clause in the by-laws provides that whenever a dispute in which a member of the Exchange is involved is referred to this committee, the member must abide by its decision or forfeit his membership in the Exchange. If the master builders' associations would adopt a similar rule, and would hold their members rigidly thereto, obliging them, under penalty of forfeiture of membership, to abide by the decision of the referees, the moral influence of such action would undoubtedly weigh a great deal in preventing legal appeal on the part of an owner. I believe that most architects and owners who are familiar at all with the workings of master builders' associations would be perfectly willing to leave their cause in the hands of a properly appointed arbitration board and to abide by its decision. Any one who has had any experience knows how unsatisfactory legal combats are, and there ought to be no difficulty in bringing about some such arrangement as suggested. May I intrude sufficiently on your columns to suggest the idea, with the hope that others may take it up, and that the master builders may see fit to provide for some such arrangement?

Du Cerceau.

DAMP PROOFING FOR CELLAR WALLS.

THE annexed figure illustrates a detail of construction which is very generally used in New York and in some other parts of the country, though it is seldom met with in the New England States. It is intended to keep the ground water and the washing of rain away from the cellar walls of a building, so as to insure a dry cellar. About 1 ft. or 16 ins. below the finished grade line a space all around the building is paved with a layer of concrete, which is pitched outwards from the walls. A heavy coat of tar, or better, natural asphalt, is applied to this surface, and carried upon the outside face of the house walls to the grade. The earth is then filled in so as to allow planting up to the walls of the building. Any water which works itself down on the outside walls would be carried away from the building by the underground paving, and there would be little opportunity for the water to work through the walls. Being under ground, the construction would be protected from the action of the elements to a certain extent, and would be likely to endure a much longer time than a paving or stonework laid level with the ground. It is somewhat surprising that this construction is not more generally used, as it would seem to have many very manifest advantages.



SAFE SCAFFOLDING.

AS the tendency of the law is to make the contractor responsible for accidents to workmen caused by defective or improper scaffolding, it should be one of the chief objects of the foreman to see that every piece of scaffolding is sound, strong, and sufficient. Many a limb has been broken and many a life lost because of the use of rotten or imperfect materials, or because enough nails have not been used in making the scaffold. Every contractor should have in stock a good scaffolding plant, suitable for all work he may be called upon to perform. The English method of using good stout poles instead of sawn scantlings is to be commended, as being safer and stronger, as the fibers of the grain are continuous throughout the whole length of the pole, whereas, in scantling, cross grain and knots render them liable to snap asunder at every sudden shock or strain. In scaffolding, when round poles are used, the putlogs or cross pieces are generally lashed to the poles with ropes, — sometimes with chains, — and this does away with the necessity of using nails to secure the brackets, and leaves the scaffolding undamaged when the work is completed. Taken all in all, this manner of scaffolding, apart from being the safest, is, in the end, much more economical than the old slovenly way of nailing. — *Canadian Architect.*

WHILE it may be rather late in the day to mention the house warming of the Chicago Building Trades Club in their new quarters at 120 Monroe Street, Chicago, it is not too late to congratulate the members on the charming appearance of their club-house on that occasion, or to refer to the character of the club and its membership, which the following extracts from the by-laws will serve to illustrate.

Object. — Its object shall be to maintain a club-house furnished with all the requirements for the advancement of social enjoyment and encouragement of friendly intercourse between the members thereof.

Who Are Eligible. — The membership of this club shall consist of resident and non-resident members, to which any person of good moral character who is or has been an employer of workmen in a business connected with the building industry is eligible.

To be qualified for non-resident membership, the person must not reside or have a place of business within a radius of thirty miles of the City Hall in the city of Chicago.

The club was incorporated under the laws of Illinois on December 26, 1895, under the following list of officers and board of management: Joseph Downey, president; Robert Vierling, vice-president; E. Earnshaw, second vice-president; Chas. W. Gindele, treasurer; Edward E. Scribner, secretary. Board of Managers: S. S. Kimbell, D. V. Purington, Murdoch Campbell, J. C. McFarland, L. L. Leach, A. Lanquist, M. B. Madden, W. H. Alsip, J. G. McCarthy, Thos. H. Dungan, J. R. Hansell, Wm. Grace, Wm. Mavor, F. S. Wright, and W. D. Gates.

A House Committee and standing committees on Finance and Membership have since been appointed from the members of the Board.

At the banquet on April 23, some very entertaining after-dinner speeches were made on subjects relative to the building trade. Mr. William H. Sayward, secretary of the National Builders' Association of America, made a strong address on "The Building Association and the Result of Its Work."

Mr. D. V. Purington presented the club with a portrait of Mr. Wm. H. Sayward, making some very appropriate remarks upon the well-known labors of Mr. Sayward in his connection with the association, from which the following is quoted: —

"Not alone are those truly great who are skilled in statecraft or in war. In every profession and avocation of life there are men who tower above their fellows. Among philosophers and scientists, among architects, builders, and artists, among lawyers, physicians, and preachers, in each and every department of human energy and intelligence, will always be found some who are preeminently above their coworkers, and who deservedly take rank with the great. No matter how humble the calling, he who stands at the head of that calling is the greatest of his class."

Our St. Louis correspondent points out very forcibly in this month's letter the evil effect, of building a brick wall with poor mortars and without a proper bond, as witnessed during the recent cyclone, at St. Louis. Nature occasionally makes a test of her own, which, as a rule, is apt to be conclusive, the lessons from which are well worthy of our most serious consideration.

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

ST. LOUIS. — In a single hour our quiet city was transformed into one of the liveliest, and ruin and devastation was found on every hand. On the morning of May 28, every builder in the city awakened to find himself with plenty of work to do, as the heavy storm which visited us the evening before caused almost incalculable damage to a large portion of the city. In the track of the storm proper there was scarcely a building left unharmed, and probably 20 per cent. of them will have to be rebuilt.

The immediate demand for mechanics exceeded the supply, and in many instances there was a desire to profit by other people's misfortunes. In a few cases exorbitant demands were acceded to, but any attempt to take such an advantage of the situation was discountenanced by labor unions and material-men; consequently there has been scarcely no advance in labor or materials.

The people soon recovered from the shock of the storm, and early the following morning commenced the rebuilding of St. Louis, building stronger and better than before; and already little remains, excepting where buildings were totally wrecked, to tell the tale of one of the severest storms on record.

The hardest part of the storm passed some blocks south of the principal business portion of the city, thereby missing our high buildings; and there has been much speculation as to whether they would have withstood the shock, many having asserted that it is impossible to construct a building to resist such a terrible strain; but this assumption seems to be rather far fetched.

As a rule, the high buildings are designed for an ultimate resistance of 160 lbs. per square foot wind pressure; and although this is a lower figure than should be taken, perhaps, there is no evidence that there was any such pressure as this at any time during the storm in its most destructive center, as it surely does not take anything like this to tear off galvanized cornices, or blow down 9 in. or 13 in. brick walls, which have no bond or anchors, and laid in mortar which does not adhere to the brick, as was found to be the case in every instance where any great amount of damage was done. All buildings which were properly constructed suffered little damage, more than the blowing off of the roof or the chimney, other than that done by the rain. A careful examination of some of the larger buildings, such as factories and warehouses which were damaged, revealed the fact that they were built without the proper ties and bonds, and often with very poor mortar. The cause of failure in most cases was in the blowing off of the roof first, which was anchored to the walls, and these timbers, in falling, caused the wrecking of other portions of the building.

In the Union Trust and Chemical Building, the two highest in the city, there was no perceptible vibration, although the wind pressure was from 62 to 65 lbs. per square foot.

A large portion of the eastern part of the city which suffered from the storm was in a state of decay, and borders on the wholesale and manufacturing district. There has been much talk of substantial improvements in this section, and doubtless they will now assume more definite shape.

In close proximity to this district are the yards of all the railroads centering in the city, and from these, on Poplar Street, the tracks turn and enter the mouth of the tunnel at 8th and Spruce Streets.

A few years ago the Cupples Real Estate Company established what is known as Cupples Station, by erecting a building covering the entire block between Spruce and Poplar Streets, facing on 7th Street, and extending west, following the curve of the tracks to 9th Street. The building is six stories on Spruce Street, and seven stories on Poplar Street, with basement and sub-basement. Switches from the main line pass through the building, giving excellent shipping facilities to the occupants of the building, it being only necessary to load the goods upon trucks and run them outside of the door, where they are taken in charge by the railroad companies, and may, in fifteen minutes after, be on the way to their destination. It would be hard to conceive of a more admirable arrangement for a building to be used for wholesale and warehouse purposes, and it is hardly necessary to say that no portion of the building ever wants for a tenant.

This venture has proven so popular that during the last two years the same company has erected several other buildings of similar character. Across the tracks, and connected with the first building by iron bridges, they built a five-story and basement building on Spruce Street, extending from 8th to 9th Streets. Directly across the street, on the northeast corner of 9th and Spruce Streets, they erected still another five-story building.

The entire half block between 9th and 10th Streets, facing on Spruce and Poplar Streets, is covered with the immense seven-story and basement, occupied by the wholesale department of the Simmon's Hardware Company, which is connected with the warehouse, which occupies a large portion of the first-named building by an iron bridge, and also by a continuous chain or carrier, by which goods are transferred from one building to another without the use of trucks, and the consequent loss of time and labor. And still further up Spruce Street, on the opposite side of 10th Street, is the six-story building occupied by the Paddock Hawley Iron Company.

The shipping facilities make this the most desirable section for wholesale and warehouses, and the location is appreciated by the property owners, as well as merchants, to such an extent that the future will see the part of the city quickly changed from an almost abandoned to a very busy center.

The buildings referred to above were all built by the same company, designed by Messrs. Eames & Young, and put up by Mr. James L. Bright, and are of the best type of slow combustion. The exterior walls are of brick, dignified and quiet, with terra-cotta or stone used sparingly as an ornament.

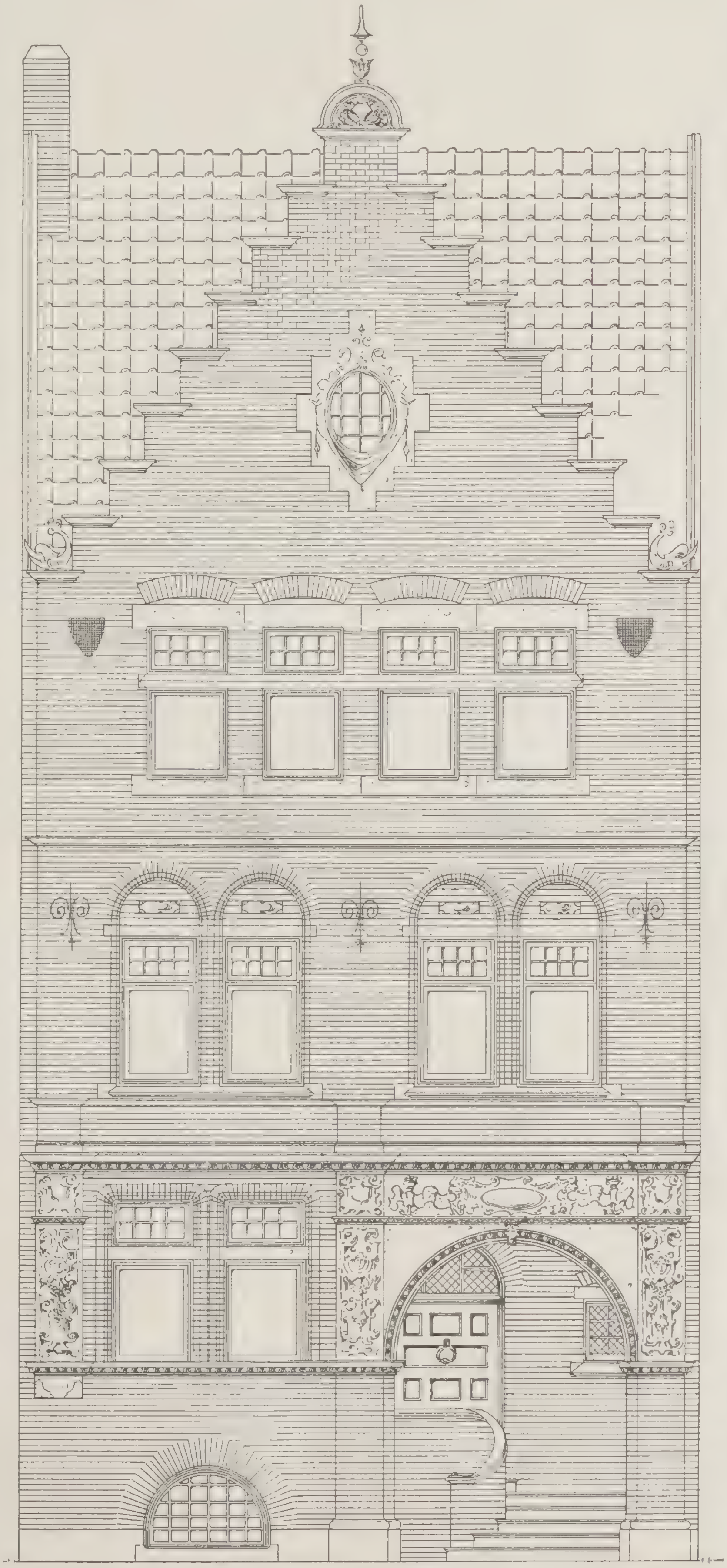
CHICAGO.— The fact was mentioned in this column that the government had awarded the contract for removing the old Post Office Building to a firm who offered $47,000 for the privilege. It turned out, however, that one party was interested in three widely different bids, his scheme being to forfeit the absurdly low pledge of $500 in case there should be no other bids between two of his own, and by having his dummy bidders disappear, he could get the contract at his lower or lowest figure, and by losing the $500 save several thousand. The scheme was detected, and after another delay the contract has been let for $15,000 to the firm who removed the remnants of the World's Fair buildings, and they agree to clear away the massive stone, iron, and concrete ruin in about five months.

Building news continues to be depressing, although there is more or less of important building in progress all the time. The foundations are going in for two more office buildings, and there will soon be others. The building of most interest at present is the Illinois Trust and Savings Bank alluded to last month. The competitive works of sixteen architects hung on the walls of the president's office a week or two, and the prize finally went to D. H. Burnham & Co. The announcement of the award was made June 6. Already the old Grand Pacific Hotel is being torn down, and it will be interesting to note how soon Chicago push will have the new building under way.

The genial treasurer of the American Institute of Architects was a member of the firm of Treat & Foltz until lately, when the veterans who affectionately call each other "Sam" and "Fritz," after pulling together a quarter century, doing a large amount of work and educating scores of young architects at the same time, decided to try it alone and each row his own canoe. One of the former works in which Mr. Foltz takes pride is St. Luke's Hospital.

Among the latest works of the firm are some important manufacturing plants previously mentioned by The Brickbuilder. Their general practise has included many apartment buildings.

People outside of Chicago who have heard so much talk about a Lake Front Park might be surprised to find even now the Illinois Central Railroad Company with a thousand men pushing their part of the work. The depression of the tracks, building of retaining walls, etc., is well along. An interesting part of the improvement is to be a $75,000 suburban underground station. As described, it will be quite elaborate in its appointments. Its beauty will be appreciated chiefly from the interior, since it is to be located under a viaduct and designed to obstruct as little as possible the view of the park and the lake from Michigan Avenue.



DESIGN FOR A BRICK AND TERRA-COTTA CITY HOUSE, BY LEWIS STEWART.

PITTSBURG. — In the competition for the new Carnegie Library at Homestead, the design submitted by Architects Longfellow, Alden & Harlow was awarded first prize; Boyd & Mercur secured second prize, and Bartberger & East third prize.

Architect U. J. L. Peoples is preparing plans for the sixth ward school building, Alleghany, to be three stories, of brick and stone. Cost, $75,000.

Architects Rutan & Russell have prepared plans for a new apartment house and hotel, to cost in the neighborhood of $350,000, to be built at corner of Penn Avenue and 5th Street, and known as "The Lincoln."

The East End Christian congregation are having plans prepared for a church to be erected on Alden Street near South Highland Avenue.

A project is on foot to erect a handsome new theater on Penn Avenue; the estimated cost is $65,000.

Architect J. T. Steen has prepared plans for a brick and stone residence for Capt. John C. Fisher, to be erected on Forbes Street, to cost about $15,000.

A. N. Speer will erect a brick and stone dwelling on Center Avenue, to cost about $19,000.

Architects Topp & Craig have prepared plans for one of the finest hotels in this city; to be erected on the corner of Smithfield Street and Seventh Avenue, fourteen stories high, and to cost about $750,000.

Architect Charles Bickel is preparing plans for a six-story business block on Smithfield Street, to cost about $40,000.

A row of old buildings fronting on Third Avenue, below Smithfield Street, will be demolished to make way for a handsome business structure to be erected by E. M. Ferguson and the Park estate.

Architect J. Steen has made plans for a six-story business buildng on Smithfield Street.

Senator Quay has recommended to the United States Senate the erection of a public building at McKeesport.

The Columbian Fireproofing Company of this city will remove their offices to New York. Mr. Wright will be in charge.

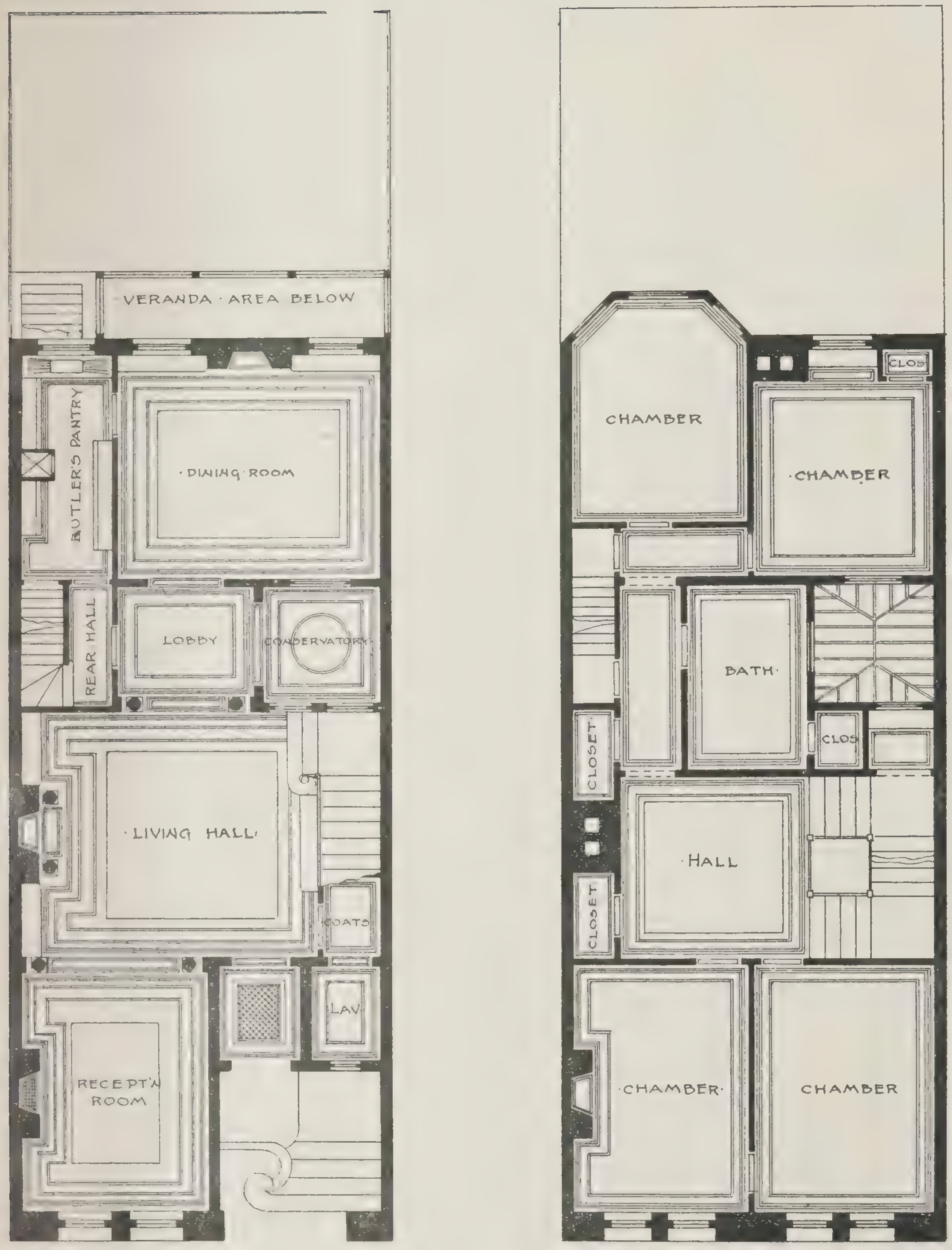
COLUMBUS. — In spite of a very "slow spring," and the indications for a slower summer which confronted us two months ago, the indications now are that the present building season will be one of some activity. All of the architects have work on the boards, and in prospect.

Architects C. A. Stribling & Co. have plans out for a business block for E. T. Mithoff, to be 62½ ft. front by 70 ft. deep, four stories high. The building will be fire-proof, the front being built of mottled Roman brick and terra-cotta.

The same architects report plans completed for a fine brick residence, for Mrs. J. M. Stuart, and a business block for Mr. W. E. Grist, of Circleville, Ohio.

Architect Riebel, who is the School Board Architect, reports a large bottling-house, designed for N. Schlee. It will be of brick, three stories high, 40 by 100 ft. in size. The same architect reports plans completed for a building for Mr. M. Switchell, to be built of brick, except the front, which will be faced with marble. The same architect has plans out for a large school building, to be erected on West Ninth Avenue. It will be built of gray brick.

Architect Linthwaite is



· PLANS ·

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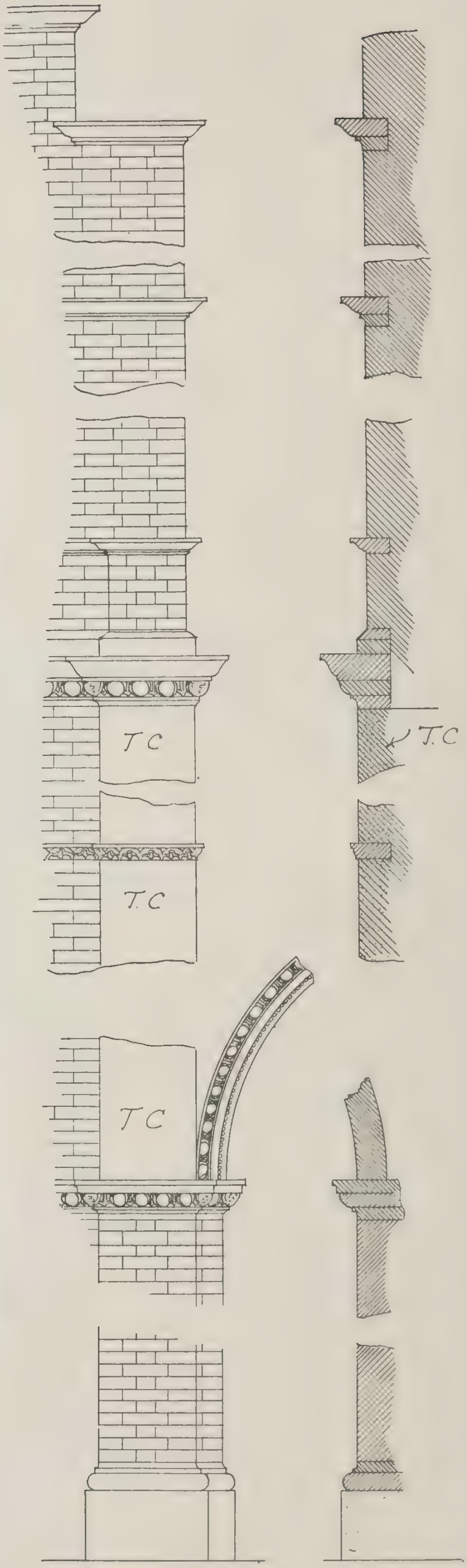

· DETAILS ·

DESIGN FOR A BRICK AND TERRA-COTTA CITY HOUSE, BY LEWIS STEWART, TRENTON, N. J.

receiving bids for the construction of a large modern apartment house for Maj. A. D. Rodgers. The building will be three stories high, and contain two flats on each floor, each one of which will consist of eight rooms, private hall, and reception-room. The apartments will be up to the best modern flats of this description, and will be supplied with every convenience.

Architects Yost & Packard have completed plans for a morgue for Franklin County, to be built of brick. The same firm have completed plans for a boiler and power house for the Ohio State University. It will be of brick.

Architect Terrel reports plans completed for a Presbyterian Church, to be built of brick, with trimmings of stone.

Architect Mathews has plans out for an apartment house, or rather a block of seven residences, to be built of brick with stone trimmings.

DETROIT — The Godfrey & Hyde fourteen-story building, better known as the "Mabley Building," as Mabley & Co. were the prospective tenants for the lower eight stories, has had a rather tough experience. The building should have been completed in April, but early in that month the projectors, being financially embarrassed, chattel mortgaged all their belongings, and being unable to obtain money, the work was suspended, and during the past thirty days liens have been filed daily. On June 10, a joint stock company was formed, to be known as the Majestic Building Company, most of the stockholders being creditors for materials or labor, and arrangements have been completed whereby work has been resumed, with a promise of completion by July 20. The building and site represent an investment of $1,500,000.

The architects very generally report that the month ending the middle of June has been remarkably dull for this time of the year, the fact being due principally to the difficulty of obtaining money on real estate security. Some fine buildings, however, are to be erected at once, among which are the following: —

Messrs. Malcomson & Higginbotham, architects of the City Board of Education, are preparing plans for three twelve-room schoolhouses, two eight-room buildings, and a four-room addition. They will all be constructed of buff pressed brick, with Ohio buff stone trimmings, and will involve an expenditure of $120,000.

Architect Richard E. Raseman has plans for a new plant for the Detroit White Lead Works, whose factory was recently destroyed by fire, including a three-story factory, 47 by 150 ft. in size, two large stockhouses, and an office building. They are to be of fire-proof construction, and will cost $60,000.

Architect William S. Joy has prepared plans for a six-story office building for the Latimer Building Company, limited, to be erected on Lafayette Avenue, near Shelby Street. The exterior will be of pressed brick; the building will contain 140 offices and will cost $55,000.

Architect Thomas A. Hyland has plans for a four-story pressed brick apartment house for Fairbairn Brothers, to be built on Randolph Street, near Miami Avenue, at a cost of $50,000.

A seven-story office building of slow-burning construction is being erected on West Congress Street for George F. Case. The plans were made by John W. Case, of Baltimore. The building will have a pressed brick and iron front, and will cost $60,000.

The plans of architect Edward C. Van Leyen for a police station house for the city were adopted in a recent competition. The building will be 68 by 70 ft. in size, three stories high, constructed of brown pressed brick with brownstone trimmings, with a red tile roof, and will cost $25,000.

Architect Harry C. Stevens has plans for a block of seven two-story residences for S. B. Macklom, to be built of buff pressed brick with Ohio sandstone trimmings, at a cost of $25,000.

Architect Joseph G. Kastler has prepared plans for a temple for the labor unions of Detroit. It is to be three stories high, 90 by 60 ft. in size, with swimming bath, billiard-room, and all modern convenience. It will cost $20,000.

Architects Baxter & Hill have plans for a handsome pressed brick residence for William L. Davies, president of the Acme White Lead and Color Works.

MINNEAPOLIS. — We seem to be in the midst of a summer dulness, expected in most lines of business, but seldom in the building lines. There is plenty of work being carried out, but very little new work appears. We confidently expect an awakening very soon, and probably a very busy season at the "wind-up."

Among the important projects are the following: —

Architects Long & Kees have planned a large building for the Wyman, Partridge wholesale dry goods company, 132 by 165 ft., seven stories and basement, pressed and ornamental brick, granite, steel construction, fire-proof. Cost, $200,000.

T. B. Walker and others have recently purchased the block of ground used by the Athletic Association, from the McNair estate, and will cover it with large wholesale buildings. This is in the center of the recent extensive improvements around Central Market.

Architect C. S. Sedgwick has planned a store and bank building at Park River, N. D., 50 by 100 ft., two stories, pressed and ornamental brick, for the First National Bank. Cost, $10,000.

Architects Stebbins, of Minneapolis, and McMillen, of Duluth, are at work on plans for a Masonic Temple for Masonic Temple Association of Aberdeen, N. D., to cost $15,000.

The North Star Boot & Shoe Company have let the contract for their new building to P. W. De Lancey, of Minneapolis, at $61,880.

Westminster Church has finally adopted plans, after a competition in which six architects were invited to compete, each being paid a pittance for his work. Architects Sedgwick & Hayes were selected. The probabilities are that the corner of Nicollet Avenue and 11th Street, now owned by Bishop Foss, of the Methodist Episcopal Church, will be the site of the new structure, which will be of brick and cost about $150,000.

Architects Orff & Joralemon, of Minneapolis, have been engaged to prepare plans for a schoolhouse at Stanley, Chippewa County, Wis.

E. P. Overmire is architect for a four-story flat building for W. P. Mealey, on Second Avenue near 16th Street, 48 by 88 ft., ten flats, pressed brick and brownstone trimmings. Cost, $25,000.

The Flour City Realty Company are erecting three double flat buildings at Hennepin Avenue and Kenwood Boulevard, from plans by A. L. Dorr, 60 by 80 ft. each; four stories, red pressed and ornamental brick and brownstone. Cost, $90,000.

Dr. A. H. Lindley will erect a three-story flat building at 16th and Hennepin Streets, to contain eighteen flats. Long & Kees, architects. Cost, $15,000.

ST. PAUL. — Architects Omeyer & Thori have plans for building at Lakefield, Minn., for Jackson County Bank, 48 by 91 ft., two stories. Cost, $10,000.

Cass Gilbert is architect for an extensive addition to Northern Pacific Company's general office building, to be L-shaped, and extend from Broadway to Pine Street, on 4th Street, and to incorporate the M. & S. L. R. R. depot building.

Milwaukee capitalists have purchased the site of the old Sibley House, and will remove the old building and make substantial improvements.

Bids for insane asylum at New Richmond, Wis., from plans by Buechner & Jacobsen, ran from $39,000 to $55,700. Emil Bruce, of Minneapolis, secured the contract. Same architects have plans for addition to Bethesda Hospital, to cost $15,000.

School board voted to build an eight-room building at Albemarle and Wayzato Streets, to cost $15,000.

J. A. Thornquist, of Minneapolis, is building a three-story flat building on Ashland Avenue, between Kent and Mackubin Streets, to cost $20,000. Herman Kutz & Co., architects.

P. H. Baker will build an apartment building on Ashland

Avenue near Mackubin Street, at estimated cost of $36,000. Kutz & Co., architects.

In the recent competitive examination for superintendent of construction of the new capitol building, there were seventeen applicants. The winner was John Boland, of Minneapolis, who has acted in the same capacity on our new county court-house and city hall building, now nearing completion.

ROCHESTER seems to be again falling into a state of quietness and depression. All the new work in the architects' offices at present is not more than sufficient to keep one good architect busy.

The chief item of interest has been the competition for a church for St. Paul's Episcopal congregation. The competitors were: — Geo. B. Post and Heins & La Farge, of New York; T. P. Chandler, of Philadelphia; and Cram, Wentworth & Goodhue, of Boston. I understand that Messrs. Heins & La Farge have been selected, their design having been considered to have the best points, one that had no clear-story and no columns in the body of the church, which seems to have been considered a fault in all the other designs submitted. Messrs. Post and Cram, Wentworth & Goodhue had perspectives that were much admired by all the architects and draughtsmen who were permitted to see them. The drawings of Messrs. Cram, Wentworth & Goodhue were unexceptionally well rendered in pen and ink by Mr. B. G. Goodhue.

Architects Chas. S. and Harvey Ellis have let contracts to Stallman Bros. for the erection of a five-story press-brick manfacturing building to be built on Elizabeth Street. Building will be modern in every respect; cost, $92,000. Also for the additions to be made to the Smith Building, to be erected on Exchange Street; cost, $25,000.

Architect J. Foster Warner has let contracts to A. Frederichs & Sons for the "Triangle Building," to be erected on East Main St., Belmont Park, and East Avenue. Building will be five stories in height. New York hydraulic press brick and Perth Amboy terra-cotta, white sandstone first story.

Kelly & Headley have a number of small buildings which are partly or wholly of brick. Stable for T. Ross Levis; three-story hotel, North St. Paul Street; Hotel at Livonia for J. B. Snyder; residence for Mr. John McIntyre, Darmouth Street.

Geo. F. Hutchison is preparing plans for a four-story manufacturing building to be erected on Stone Street. Building will be mill construction. Size, 40 by 60 ft.

J. Mills Platt, formerly head draughtsman for Nolan, Nolan & Stern, has opened an office for the practise of architecture at 918 Chamber of Commerce Building.

Messrs. Kelly & Headley have removed from the Cox Building into the new Cutler Building.

GRAY BRICKS.

OF all the tints that are now in vogue, none stands higher in estimation than the divers shades of gray. The reason architects use gray and cream-colored stones is because on weathering they tone down so well. Now, the average brick, as typified by ordinary reds, may tone down as much as it likes, but it never presents that grand appearance characteristic of, say, Portland stone. Gray terra-cotta has made its appearance, and is being highly appreciated. At first it looks rather fresh, and in that respect agrees with the natural product alluded to, but it will soon improve in color and take its rank accordingly. Of course, gray bricks have to be made from suitable earths, and nothing can be expected from the brick earths now ordinarily employed, as gray tints could not result from them unless mixed with chalk or some such substance which would impair their general quality. At the same time, something might be done in that direction, especially with earths not containing an excess of lime, by the addition of certain ingredients depending on the precise character of the earths. — *British Brickbuilder.*

JUST ABOUT OUR OWN CASE.

WE venture to suggest that the Royal Institute of British Architects, or that younger and more progressive society — the Architectural Association,— should pay a series of visits to yards where various forms of brickmaking are carried on. At the present time the general opinion among younger London architects is that most bricks are made by hand, and there are very few who could detail the essential points of difference between the manufacture of dry and plastic bricks, or have ever seen either of the systems at work. Many architects who have spoken to us upon brickmaking have done so in slightly contemptuous tones, and with a sniff of the nose. These men have never seen anything but small suburban yards, where evil smells abound and confusion apparently reigns supreme. We would like to take some of our friends to the North, or even as far as Peterborough. What an eye-opener it would be to them, and what a far greater interest they would take in bricks after that! — *British Brickbuilder.*

AN OLD BOSTON FIRM REMOVES TO NEW QUARTERS.

THE firm of Waldo Brothers, so closely identified throughout New England with the building trade generally as one of the oldest jobbing houses in the line of high grade building materials, announce their removal, July 1, from their present location, 88 Water Street, to 102 Milk Street (three doors below Post Office Square), that they may have better office facilities and a larger display room for the exhibition of the lines of clay products which they handle.

The company was founded in 1869 by J. Adam Waldo, and but two changes since then have been made in the firm. For the last fifteen years, Chas. S. Waldo has been sole partner.

The original office of the company was at the corner of Kilby and Water Streets, within one door of their present location at 88 Water Street. At this last address they have done business for sixteen years. The new store into which they move July 1 is but a block distant, and is centrally located in the business district of Boston.

NEW TRADE LITERATURE.

A CATALOGUE of much interest and value is that issued by the Columbus Brick & Terra-Cotta Company, Columbus, Ohio. The entire catalogue is given up to the illustrating of their special make of shaped bricks, and the proper methods for joining different shapes in cornice, angle, and arch work. Size and projection of each brick is given, and almost any question likely to arise regarding the use of shape brick seems to have been answered in this catalogue.

THE PHILADELPHIA & BOSTON FACE BRICK COMPANY will issue this month a very complete catalogue of some forty pages, showing over six hundred patterns of their molded shapes. The bricks are drawn to a scale, and all of the projections are noted on each brick.

It is one of the most complete and best working catalogues of molded brick ever issued. Copies will be sent on application to the company.

THE La Salle Pressed Brick Company, La Salle, Ill., has issued a new catalogue illustrating the shapes and patterns of their brick. All of the illustrations are made at a scale of one quarter to one inch, the projection being indicated on each of the shape bricks. Copies sent on application.

FOR SALE AT LOW PRICES.

ONE 75 Horse-Power Engine, Tufts builder, also one 150 Horse-Power Greene Corliss Engine. Both in good order, being removed to install larger plant. Immediate delivery. Address, Goodyear Rubber Company, Middletown, Conn.

ITEMS WORTH READING AND REMEMBERING.

B. S. Tolan, Fort Wayne, Ind., has been appointed architect for a new $500,000 court house to be built in Fort Wayne, Ind., for Allen County.

The Union Akron Cement Company, of Buffalo, is supplying the cement for the Malone Water Works Company, Malone, N. Y.; also for street paving in Detroit.

The Tiffanny Pressed Brick Company, Chicago, are furnishing their enameled brick for the Toledo & Ann Arbor Railroad Depot at Toledo, of which W. T. Cooper is the architect.

The Pioneer Fire-proof Construction Company, of Chicago, have closed the following contracts for fire-proofing: —

Fifth contract on Hennepin County Court House, Minnesota; Wasseca County Court House, Wasseca, Minn.; Fraser & Chalmers's Warehouse, Chicago, besides about a dozen other small contracts.

The La Salle Pressed Brick Company, of La Salle, Ill., has opened an office in the Marquette Building, Chicago, where samples of their red, buff, pink, and brown brick may be seen. George B. Engle, Jr., one of the best-known brick men in the country, will have charge.

The American Terra-Cotta & Ceramic Company, of Chicago, will furnish the architectural terra-cotta on the following new work: Germania Building, Milwaukee, Wis., Shnetzky & Liebert, architects; House for the Friendless, Chicago, Charles H. Frost, architect; Post-Graduate Medical School, Chicago, Dwight H. Perkins, architect.

The Commercial Wood & Cement Company, of Philadelphia, Penn., have opened an office in the Presbyterian Building, No. 156 Fifth Avenue, New York City, to better facilitate the handling of the large trade they are building up in New York and the New England States on their Rosendale and the "Vulcanite," "Commercial," and "Gem" Portland cements.

The Powhatan Clay Manufacturing Company, of Richmond, Va., have furnished their light-buff bricks for three store buildings on Main Street, Richmond, and have also closed contracts for five residences on South 5th Street, same city, two of which are faced with red pressed brick, two with iron spotted brick, and one with gray.

The Sayre-Fisher Company, whose New York office is at 207 Broadway, will supply their buff brick for the new Astor Hotel, on Fifth Avenue, H. J. Hardenbergh, architect. This firm manufactures their brick after the clay-tempered or mud brick process. By this process the bricks are made very dense and hard, absorbing little or no moisture, and are guaranteed to retain their color.

The Dyckerhoff Portland Cement, which was used in the Metropolitan Sewerage Construction, Boston, is now being employed in the construction of the Boston Subway. The more interesting features in connection with the construction of this immense Subway will be fully described in later numbers of The Brickbuilder. These will include statistics and data in connection with the use of cements and bricks in this vast undertaking.

The Standard Dry Kiln Company, of Indianapolis, have closed a contract with the National Brick & Terra-Cotta Company, of Passaic, N. J., for a ten-track drier, 116 ft. long, for drying soft mud brick, and another with the Ohio Mining & Manufacturing Company, whose office is in New York, 41 Wall Street, for an eight-track drier, 116 ft. long, for drying dry-press brick. This is to be erected at their new plant at Shawnee, Ohio.

The Fawcett Ventilated Fire-proof Building Company, of Philadelphia, has closed the following contracts for their system: new office building, Girard Estate, Chestnut Street, Philadelphia, J. H. Windrim, architect; new office building for Waitman Estate, Chestnut Street, Philadelphia, Willis G. Hale, architect; Physicians' & Dentists' Building, Chestnut Street, Philadelphia, Wilson Bros. & Co., architects; also Catholic Boys' Protectory, Philadelphia, by the same architects.

The Powhatan Clay Manufacturing Company, of Richmond, Va., are supplying the red pressed bricks for the addition to the State Lunatic Asylum at Williamsburg, Va., Carl Ruehrmund, architect. Also for the large mercantile building, which is being erected on the site of the old Richmond Theater, Broad Street, Richmond. Their cream-white bricks will be used in the new store building at the corner of Sixth Avenue and 19th Street, New York City, as well as several private residences in same city.

The Celadon Terra-Cotta Company, Charles T. Harris, lessee, will supply their roofing tiles on the following contracts: —

Josephine Hospital, St. Louis, Mo., Tulley & Clark, architects; Court House, Knoxville, Iowa, M. E. Bell, Chicago, architect; Electric Light and Power Station, Garfield Park, Chicago, J. L. Sillsbee, architect; Station at Cuba, N. Y., for the Erie Railway Company, G. E. Archer, New York, architect; City Hall, Elmira, N. Y., Pierce & Bickford, architects.

Henry Hussey & Company, 84 Harrison Avenue, Boston, have supplied their Eureka Basin, Bath, and Urinal Traps in a great number of the buildings lately erected in this section, among them being the Grosvenon Building, Providence, Winslow & Wetherell, architects, where some 450 were used; the Litchfield Building, Boston, Cabot, Everett & Mead, architects, where 225 were used; the Castle Square Hotel addition, in which were placed over 400 and the Hotel Savoy, Boston. These traps are constructed on sanitary principles which insure a perfect water seal.

Chambers Bros.' Company, of Philadelphia, who may be depended upon to do business when there is any, have recently taken an order for their brick machinery to be sent to France. This certainly must be taken as an indorsement by the clay-workers of that country, as the company has previously sold their machinery to French manufacturers. In addition to the above, they report that they have just started a complete clay-working plant in Virginia, and are shipping to Tennessee and Georgia machines for making street paving bricks.

G. R. Twitchell & Co., of Boston, will furnish bricks on the following work: Methodist Church, Newton, Mass., Cram, Wentworth & Goodhue, architects, 100,000 Ridgway gray brick; apartment house, Shawmut Avenue, Boston, P. A. Tracy, architect, 40,000 Ridgway buff brick; interior work in new station at Providence, R. I., for the New York, New Haven & Hartford Railroad, 100,000 Ridgway buff brick. Messrs. Twitchell & Co. are the New England representatives of the Ridgway Pressed Brick Company, Ridgway, Penn.; also the American Fire Brick & Clay Company, Mineral Point, Ohio.

Meeker & Carter, 14 East 23d Street, New York, N. Y., have contracts and are making deliveries on the following buildings: —

Altman Building, 18th Street near Sixth Avenue, Kimball & Thompson, architects, Mark Eidlitz & Son, contractors; white enamel and buff bricks.

Standard Oil Building, Kimball & Thompson, architects, George Vassar & Son, builders; large quantity of buff brick.

Dormitory Building, University of New York, McKim, Mead & White, architects; large quantity of yellow-gray brick.

Besides these they are supplying a number of smaller jobs where quantities of brick used run from 10,000 to 40,000.

The Moore & Wyman Machine Company, Boston, Mass., have recently equipped with their elevators, or have now under process of equipment, the following buildings: —

Electric passenger elevators: The Connecticut Mutual Life Insurance Company's Building, Hartford, Conn.; John C. Haynes Building, Congress Street, Boston, Mass.; John C. Haynes Building, Boylston Street, Boston, Mass.; Boston Dry Goods Company's Building, Bedford Street, Boston, Mass.; Watson Estate Building, Franklin Street, New York, N. Y.; A. B. Ogden Building, Madison Avenue and 79th Street, New York, N. Y.

Hydraulic passenger elevators: New apartment house, Annie C. Doyle, owner, 150th Street and St. Nicholas Avenue, New York, N. Y.; Monte Cristo apartments, 123d Street and Seventh Avenue, New York, N. Y.

Freight elevators: Franklin King Building, 74 Purchase Street, Boston, Mass.; Demmon Building, corner East and South Streets, Boston, Mass.; Highland Spring Brewery, Roxbury, Mass.; Dayville Woolen Company, Dayville, Conn.

THE NEW YORK ARCHITECTURAL TERRA-COTTA COMPANY report the following contracts: —

Starting with New York, the chief item in point of size and architectural merit is the Bank of Commerce. Cedar and Nassau Streets, another skyscraper of twenty stories, of which Jas. B. Baker is the architect. An office building on Broadway and White Street, John T. Williams, architect and owner.

In Brooklyn there is a building for the Society for the Prevention of Cruelty to Children, Montrose W. Morris, architect.

The Hartford Fire Insurance Building, Hartford, Cady, Bergh & See, architects, New York.

Baltimore, Md., the Brewer's Exchange, Joseph Evans Sperry, architect.

Philadelphia, the Merion Cricket Club Buildings and the Parish Buildings, Holy Trinity Church, of which Messrs. Furness & Evans are the architects. The contract has also been closed for a very extensive operation on the Girard Estate, from the design of Mr. J. T. Windrim. There is also a large factory building for the S. S. White Dental Manufacturing Company, Boyd, Boyd & Roberts, architects.

In Albany, three residences of a very ornate character, wholly in terra-cotta and brick, the conception of Marcus T. Reynolds, architect, of that city.

IN the last issue of THE BRICKBUILDER, under the title "A Growing Demand for White Brick," the assertion was made that the popularity of the lighter shades was not to be regarded as a passing fad, but rather a permanent adoption of color themes that would continue to increase in favor as time elapsed, by virtue of their lasting attractiveness. This has, in a manner, already demonstrated itself, for the buildings constructed ten or fifteen years ago, in which there was a departure made from the then prevailing dark shades of materials, and light bricks were used, have not only continued in favor, but have added to their popularity by fact of their color having a permanent charm.

A good example of this is the John A. Andrews House (McKim, Mead & White, architects), situated on Commonwealth Avenue, Boston, Mass., which was built some ten years ago of a gray speckled brick of a soft, warm shade. It is well worth notice in this respect, as it has been an object of favorable comment year by year because of this quality of its color.

As a companion to this house in point of similarity in color, is the Webster House, situated on the opposite corner, at 306 Commonwealth Avenue (Dwight & Chandler, architects). At the present writing this last-mentioned house is just nearing completion, a gray speckled brick being used, of 12 by 1½ in. dimensions. The molded work consists of fluted columns and horizontal string-courses of same brick, caps and sills of terra-cotta to match.

In connection with the two houses is an interesting fact which has come to our notice through the courtesy of Messrs. Waldo Brothers, who supplied the brick for both. This is, that the manufacturers, namely, the Perth Amboy Terra-Cotta Company, who made the brick for the Andrews House over ten years ago, have since tried to reproduce the exact shade, but without success until recently, when they succeeded in so doing in the bricks used in the Webster House, which are, barring the necessary toning down of color by exposure, a perfect match.

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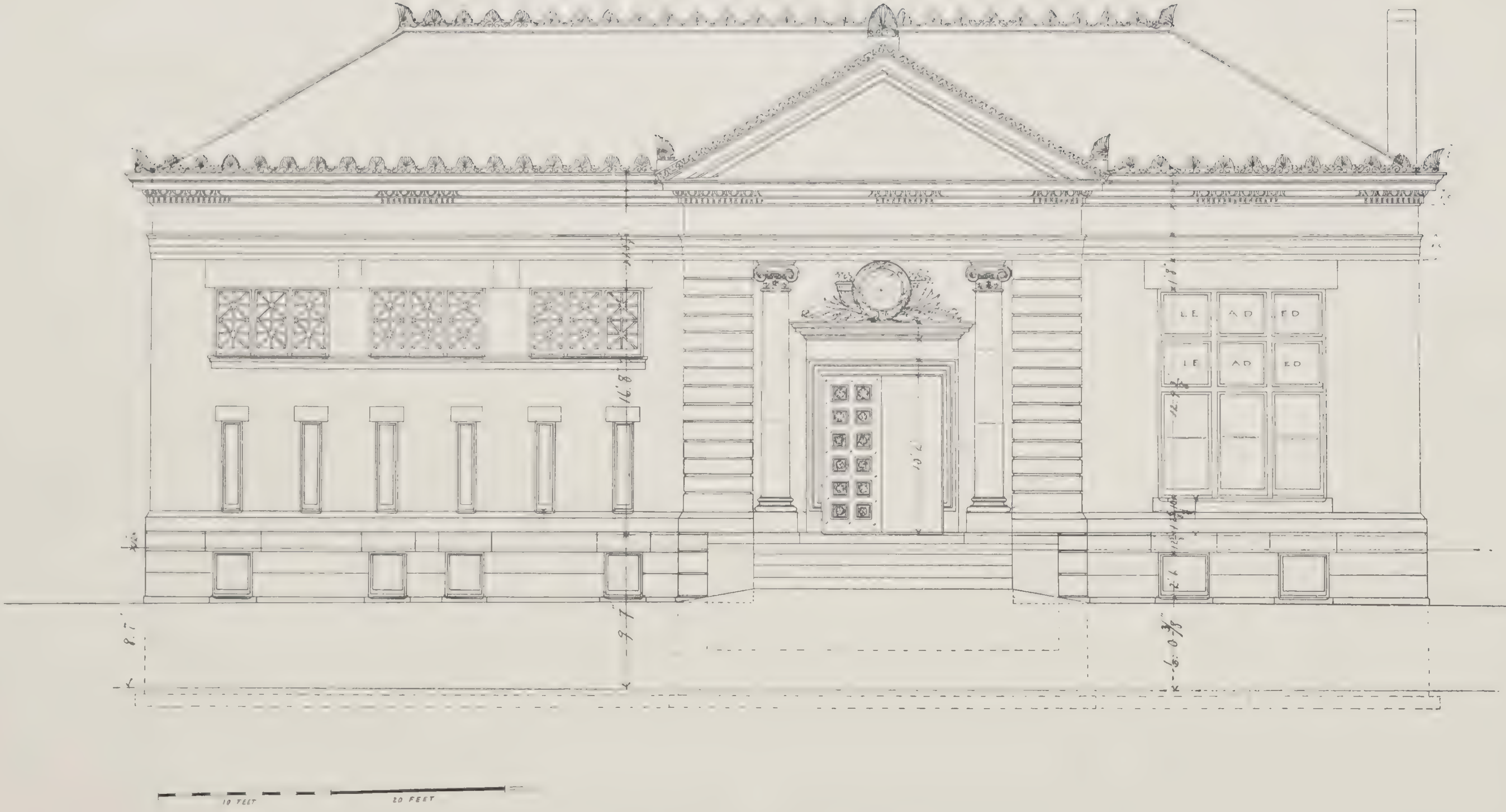
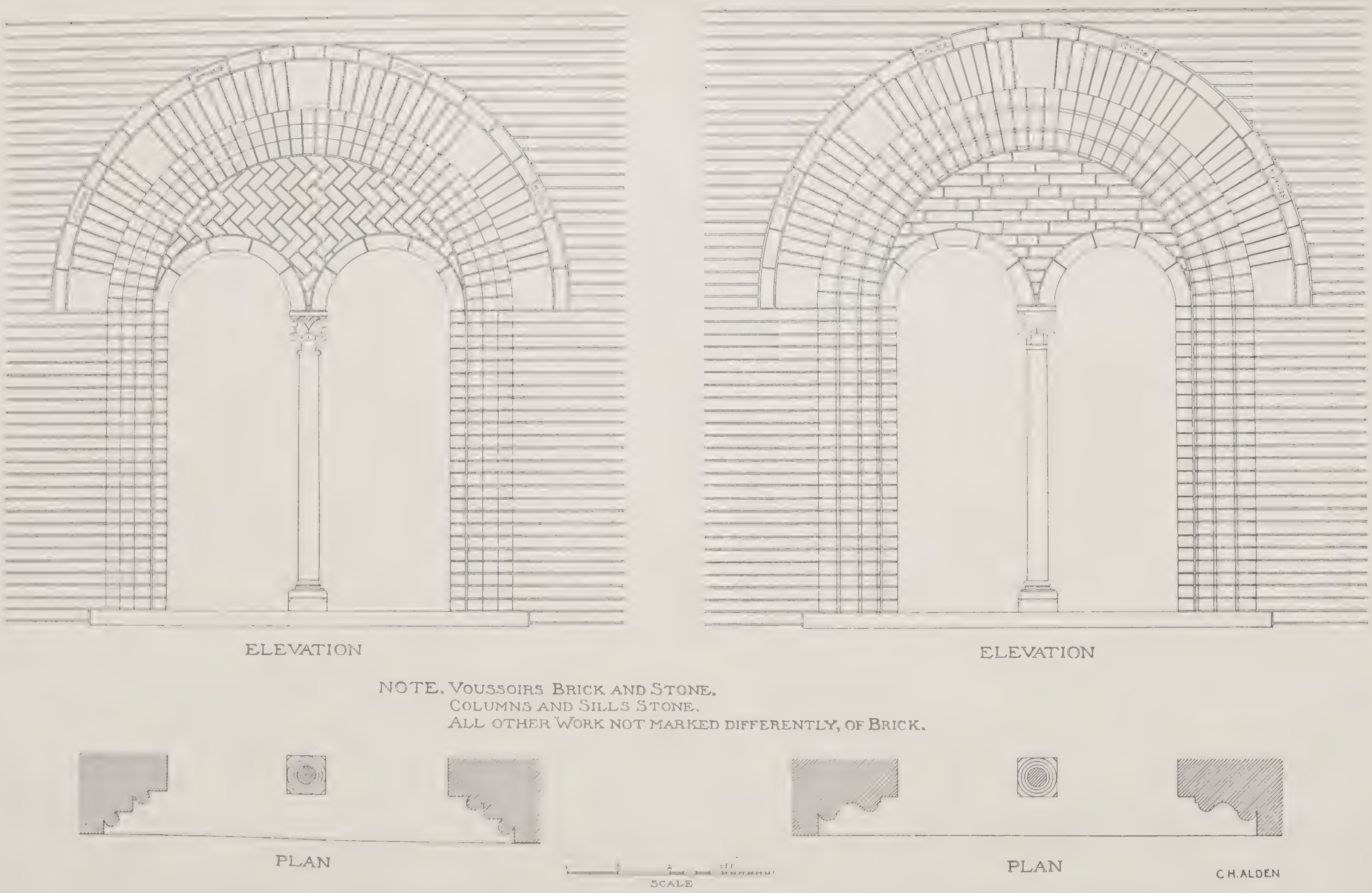


GREENWICH PUBLIC LIBRARY,

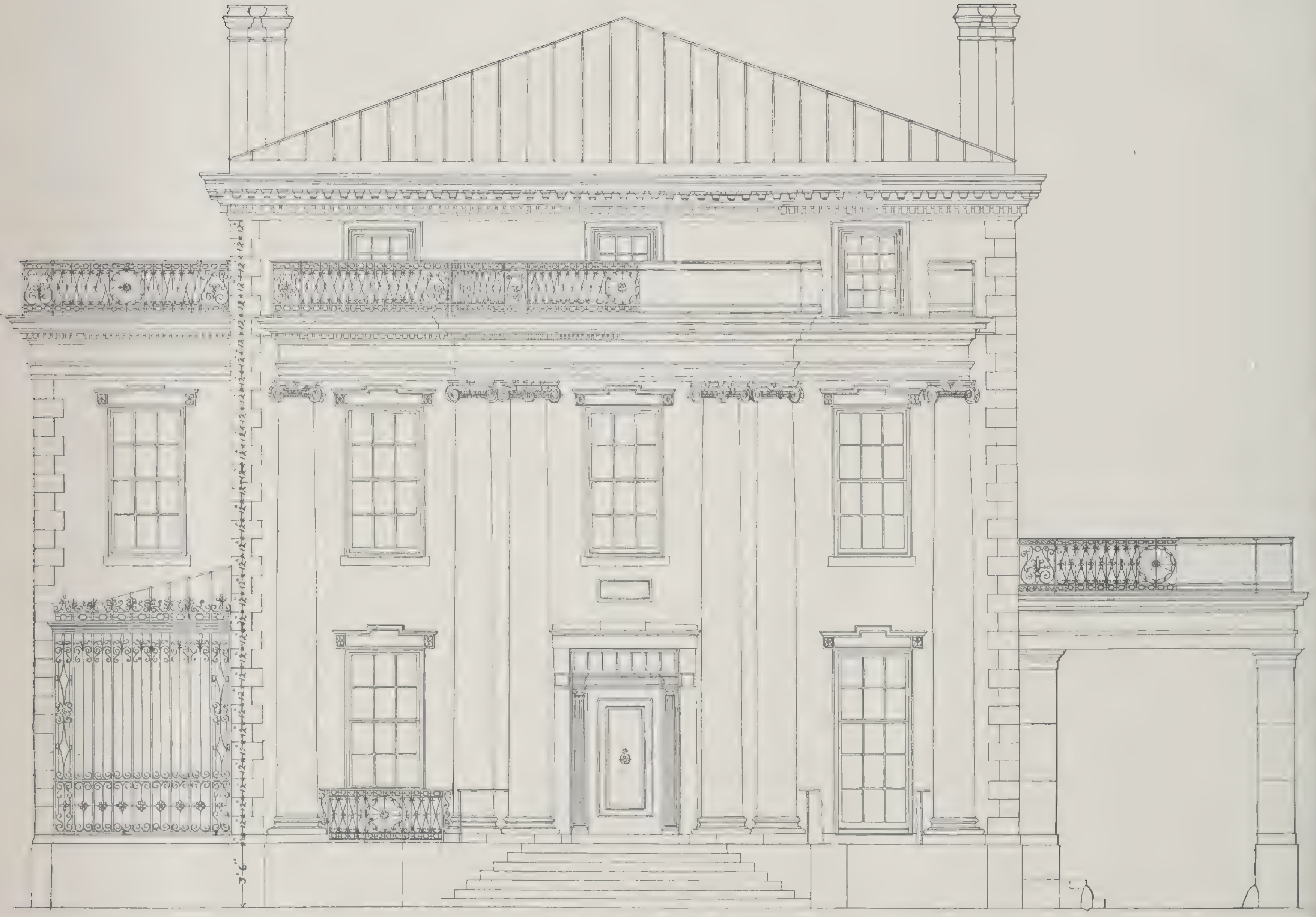
LAMB & RICH, Architects.



NOTE. Voussoirs Brick and Stone.
Columns and Sills Stone.
All other Work not marked differently, of Brick.

MEASURED DRAWING OF WINDOWS ON WEST SIDE OF MUNICIPIA MONZA. THIRTEENTH CENTURY.

THE BRI
VOL. 5. NO. 6.

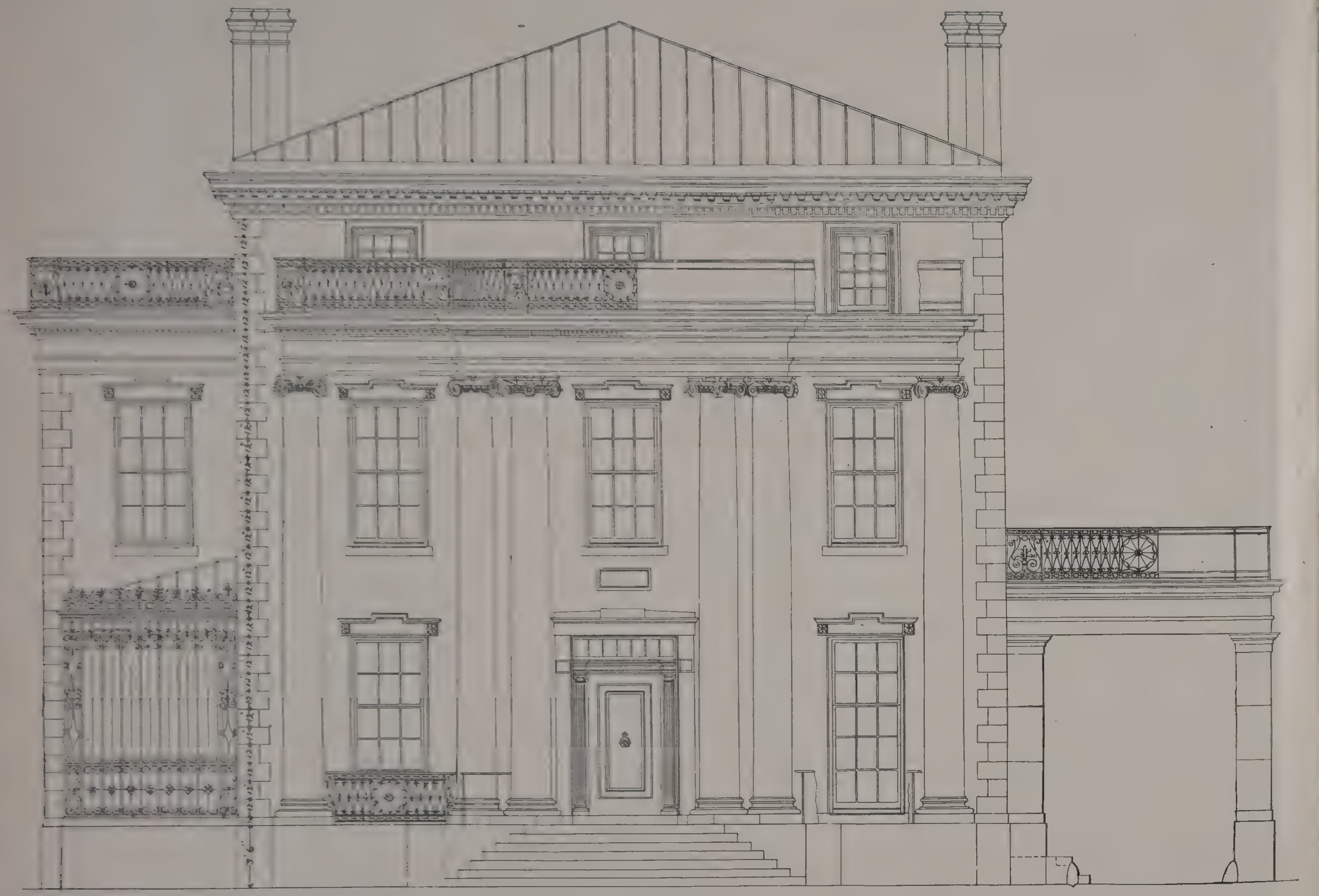


EAST ELEVATION·

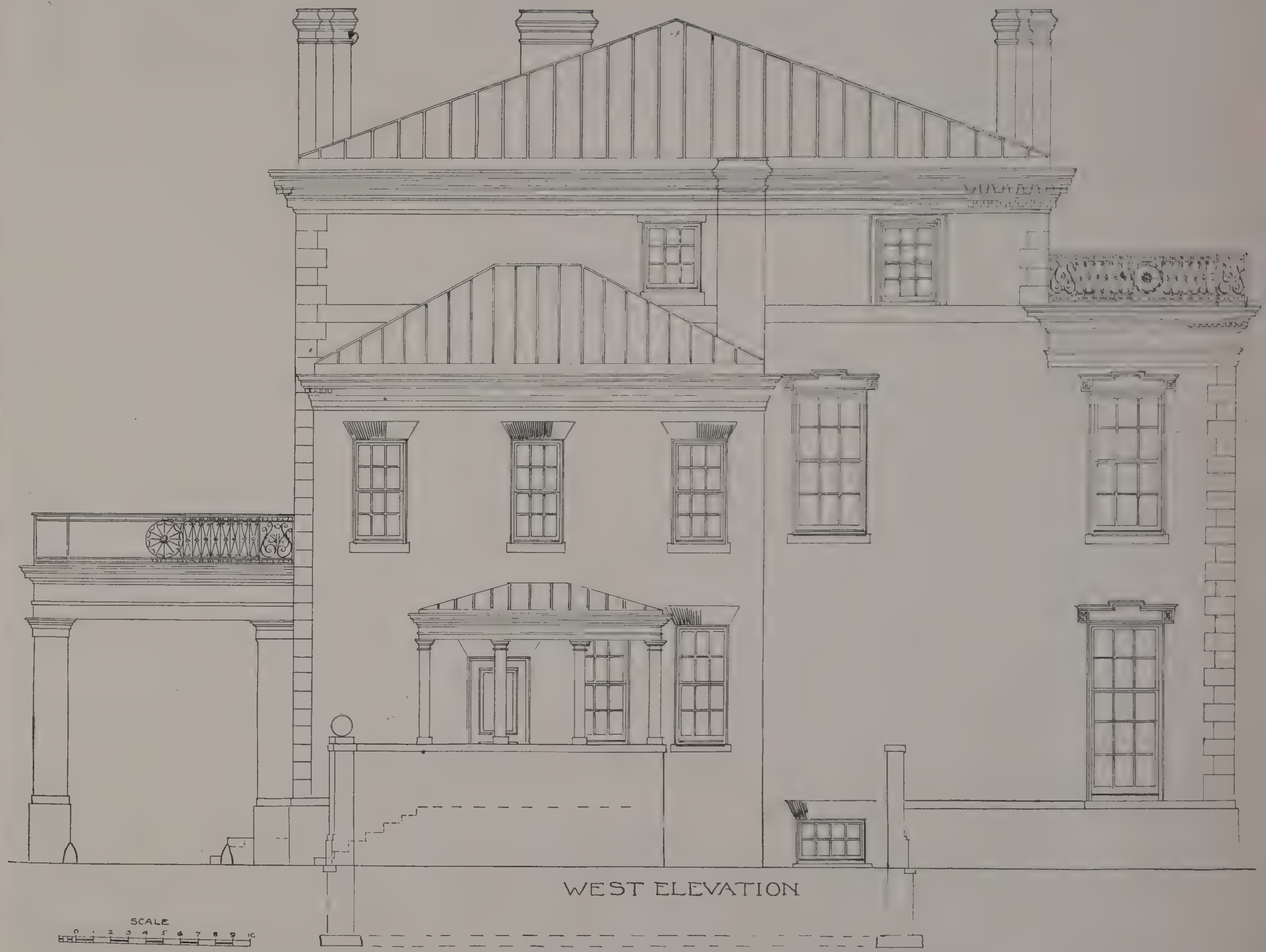
HOUSE FOR CHA
BUF
McKIM, MEA

THE BRICKBUILDER.

VOL. 5. NO. 6. PLATES 33 and 34.



EAST ELEVATION.



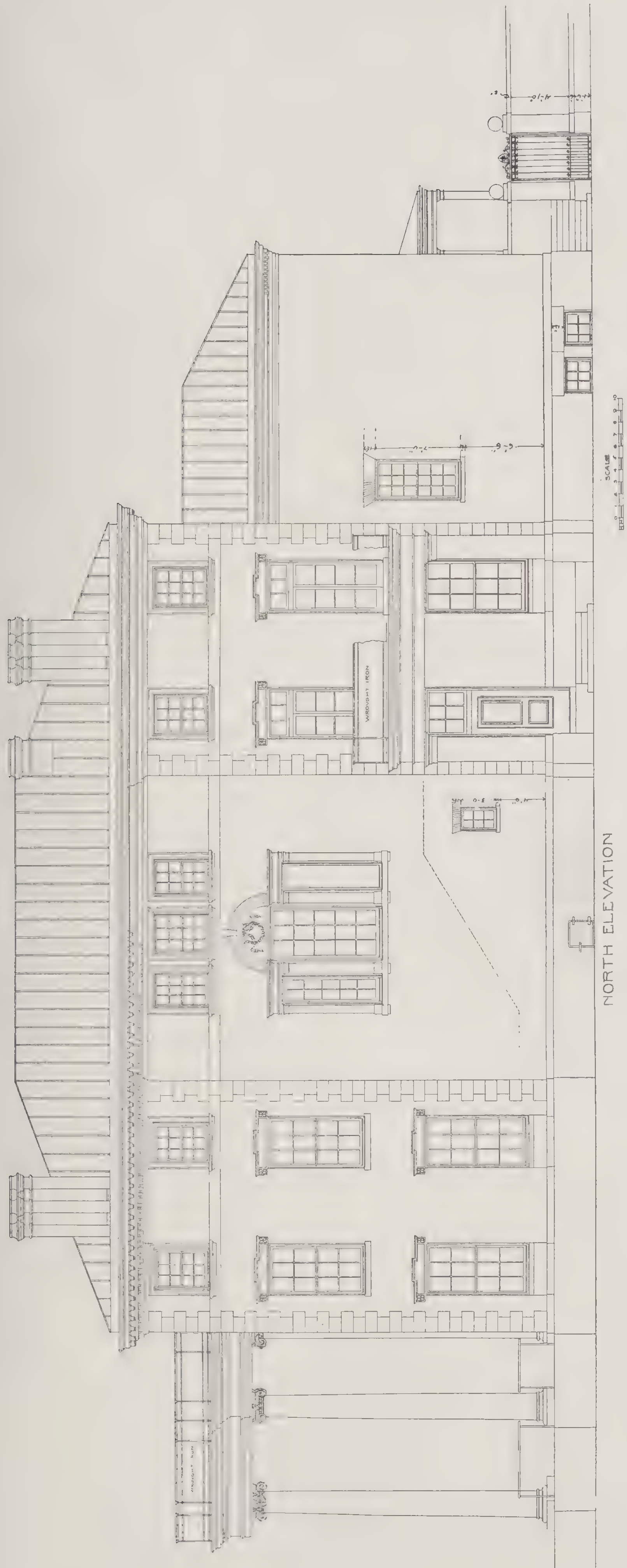
WEST ELEVATION

HOUSE FOR CHARLES H. WILLIAMS, Esq.
Buffalo, N. Y.
McKIM, MEAD & WHITE, Architects.

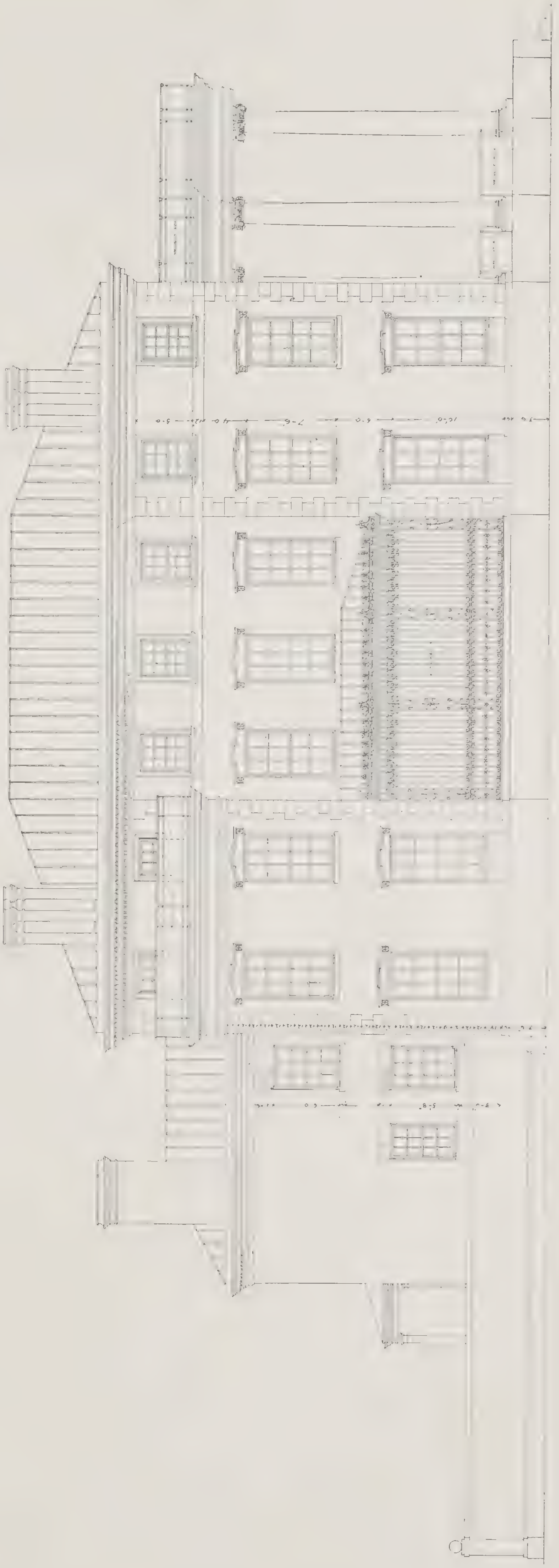
BOSTON PUBLIC LIBRARY

THE BRICKBUILDER.

VOL. 5. NO. 6. PLATE 35.



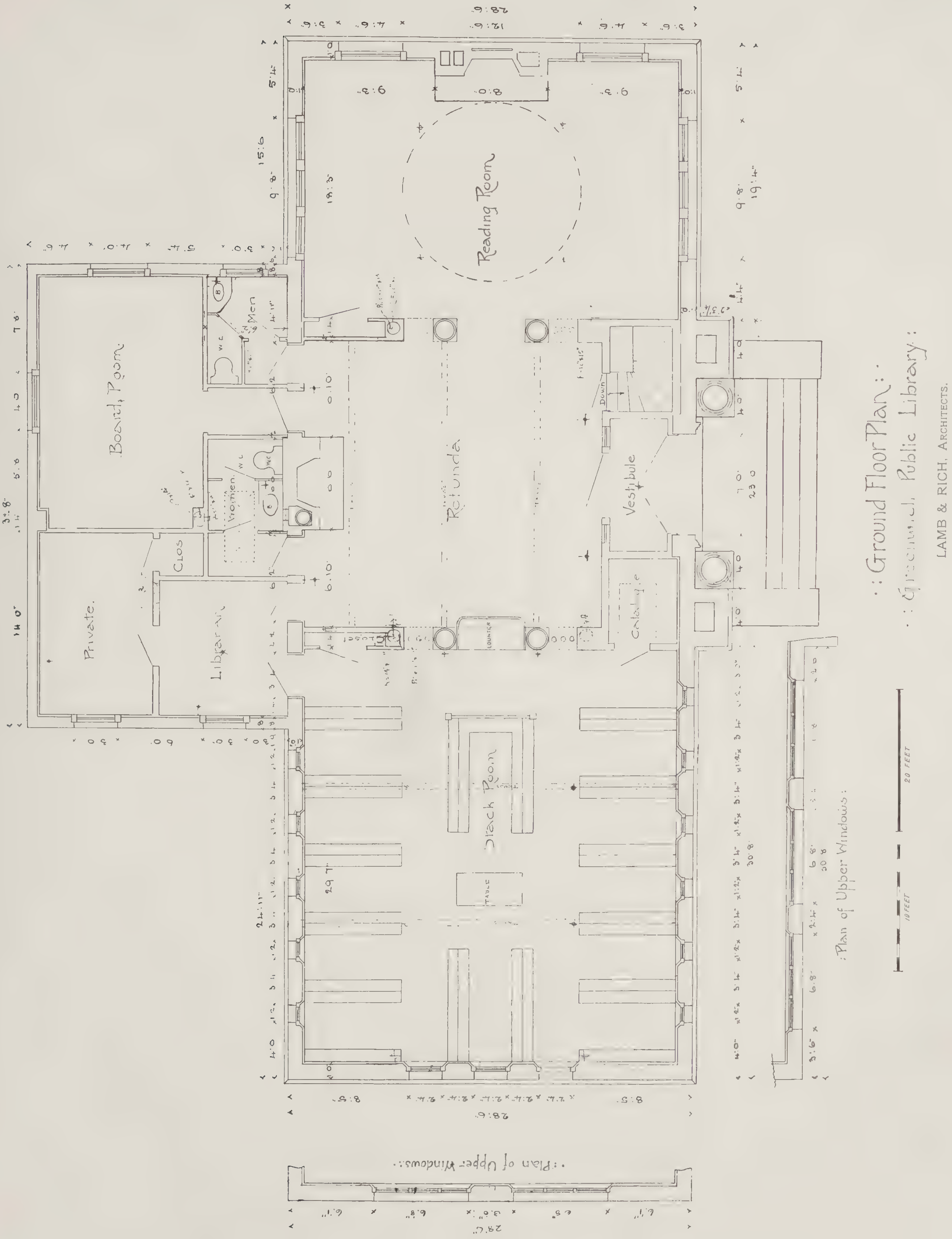
NORTH ELEVATION



SOUTH ELEVATION.

HOUSE FOR CHARLES H. WILLIAMS, ESQ., BUFFALO, N. Y.

McKIM, MEAD & WHITE, ARCHITECTS.



: Ground Floor Plan :

: Greenwich Public Library :

LAMB & RICH, ARCHITECTS.

VOLVME
V
JULY
1896
No. 7

THE
BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada . . . . . . $2.50 per year
Single numbers . . . . 25 cents
To countries in the Postal Union . . . . . . $3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

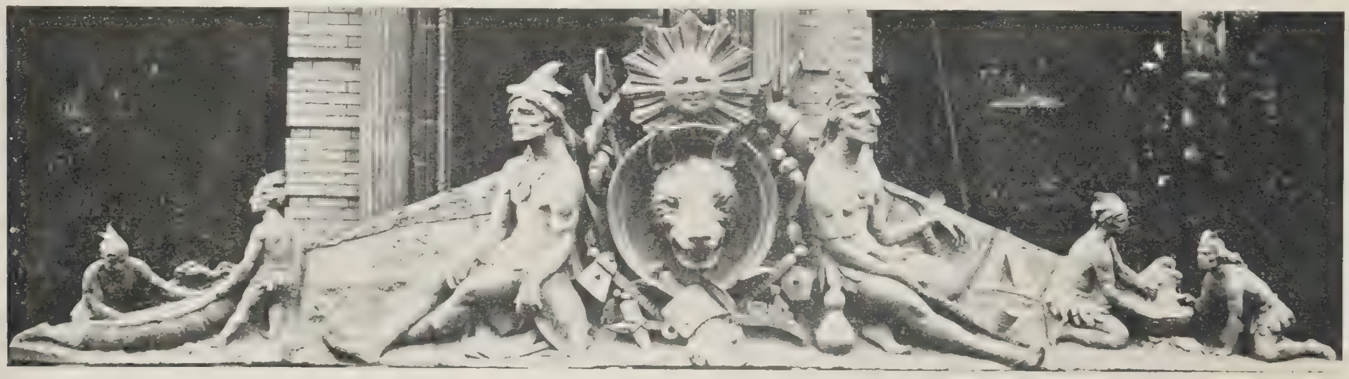
BRICK FOR COUNTRY HOUSES.

ONE of our contemporaries published some time since an editorial regarding what it was pleased to designate as the blighting influence of brick architecture, expressing a hope that the brick age would not reach the country, and that our suburbs might be spared the infliction which was assumed to be a necessary concomitant of the use of brick. An expression of this sort is manifestly based upon very weak arguments, for where brick is used in an uninteresting manner the fault is not with the material nor its implied surroundings, but with the individuals who did not know how to rightly design or place it. Indeed, we would be inclined to turn the words of our contemporary around and express the hope that the untoward influence of our wooden shanties may soon cease to affect the designing of our city houses; that the age of wood, having served its purpose, may be superseded by a period wherein our country houses no less than our city dwellings may receive a fair attention, and permanence and fitness of material be considered quite as much as mere beauty of color or form. We, as a nation, may feel justly proud of what has been done in the past with our wooden houses. We have evolved from the primitive clapboard or shingle hut of our New England ancestors a style of wood architecture which is unique, appropriate, and in many ways very fully answers our needs, but it has all the defects of the material employed. There are many instances of wooden houses which have outlived successive generations, but no one, we believe, will question the greater durability of brick and stone over anything which could be expected of shingles and studding. Wood has been so cheap in this country that it is the exception to find anything else employed for a country house. The exceptions, however, are sufficiently numerous and successful to show to any candid observer how much more satisfactory a brick house can be than one which is built entirely of wood, as, for examples, the delightful old brick house on the main street of Weymouth, or the charming brick houses at Salem. Because there have been miles of barren, uninteresting city houses erected without design, and without reason, we cannot argue that necessarily all brick houses are to be built after the same standard. There are very few effects attainable in a wooden house which cannot be improved upon in nearly every sense by the employment of brick. Wood has a proper function in conjunction with masonry. We can use it to advantage for our roofs and for our finish, but the house which is to be cool in summer, warm in winter, standing the wear of the elements in such a manner as to improve in appearance each year rather than lose, must be built of brick or stone. We come across such houses occasionally in unexpected parts of this country. In the neighborhood of Trenton there are a few delightful old masonry houses, cottages they would be called in England, which are far preferable in every respect to any of our shingled castles. Again, the best of the Virginia and Maryland houses are constructed almost without exception in brick, and throughout New England there are a number of very interesting, picturesque, and livable brick country houses. Indeed, we are inclined to believe, if the work of this country previous to the year 1830 were to be considered, it would be found that our best country houses, those which most commend themselves to the judgment of the artist as well as to the practical constructor, are built of brick. We have had occasion in these columns to refer to the use which the English and the Dutch are able to make of brick, and have noted the remarkably successful results of their efforts. We never think of an English cottage as being constructed of anything but masonry, and wood as a building material is relatively almost unknown in Holland; and yet probably nowhere else in the world can there be found such charming, picturesque, homelike dwelling-places as in these two countries. The use of any one material in itself will not create a national style nor insure excellence of production, but if in this country we should once fairly set the fashion of using brick for our country houses, in a short while we would look back in amazement at the years of persistent effort persuade ourselves that a shingled house would answer every requirement of a summer residence. The picturesque qualities which we admire are certainly well brought out in our wooden constructions, but all of them, and far more, are possible with brick. We ought to take the good points of our wooden architecture, its overhanging eaves, strong shadows, broad roof surfaces, and quiet masses of color, and combine with these the depth of reveal, the appearance of stability and strength, the restful tones of the brick, and the added warmth and coolness for winter or summer, which are possible with masonry. There is no reason why our country houses should not be fully as picturesque and enjoyable as those in England; though in this connection we must bear in mind that the English pay attention to the externals of a house to an extent with which we are very little familiar. Our average country house has, perhaps, a honeysuckle or wisteria climbing over the porch, a few rose-bushes at one side, no fence in front, and a patch of lawn which can be used for tennis for the edification of all passers-by. The Englishman or

Dutchman, on the other hand, builds his house to last for generations, sets it back from the street, surrounds it with plants, shrubs, and flowers, serving the double purposes of adornment and concealment, and making the English country house or the Dutch villa a charming place of residence which we admire but do not seriously try to imitate, or at least when we do imitate it, we are so reluctant with our projections, so sparing with our detail, or so insufficient in our surroundings, that the result is barren and uninteresting, simply because we do not half do our business. Architecture in this country has evolved itself from the hut upward in distinction to the rule in Europe, where the evolution has been from the palace downward, and our wooden country houses show all the marks and limitations of their origin, while we cut ourselves off from a great deal of the enjoyment which our foreign cousins are able to derive from a solid, substantial, and yet picturesque and homelike brick structure. There need be nothing barren about a brick house except the emptiness of ideas on the part of the designer.

ILLUSTRATED ADVERTISEMENTS.

THE adjoining illustrations of two tympana are from the Lake and Church Streets elevations of the new City Hall, Elmira, N. Y., now approaching completion, and of which Messrs. Pierce & Bickford, of Elmira, are the architects. Some aspects of life among the Indians in that part of the State, and of which this valley was once a favorite habitation, are depicted on the Lake Street pediment. The head of the wolf, that animal being the totem of the Senecas, is placed in the center. To the one side the good man of the house, surrounded by his Lares and Penates, enjoys the pipe of (in this case) domestic peace, while his squaw and, presumably, her eldest daughter, grind sufficient corn for breakfast. On the other side sits a stalwart brave amidst implements of war and of the chase. Two other figures towards the river's brink launch a canoe with the apparent intention of joining the boating party seen in the distance, and from this it may be inferred that the champion oarsmen of the Six Nations are having a gala day on the Chemung.



Let the imagination leisurely fill in the details of the picture, for in walking around to Church Street something over a hundred years have elapsed. What a transformation! Liberty sits enthroned with the Stars and Stripes for a background. The emblems of her defense are brought into view, and between them the eagle screams. The spread of learning and the advancement of science and art are well represented on one side, while the mechanical and agricultural industries, with which are allied trade, commerce, and locomotion, are symbolized on the other.

Mr. Louis Roncoli, Italian by birth, artist by instinct, and American by preference, was the modeler. He has been with the New York Architectural Terra-Cotta Company for ten years, and has conceived as well as executed many subjects of merit, some of which have appeared in THE BRICKBUILDER.

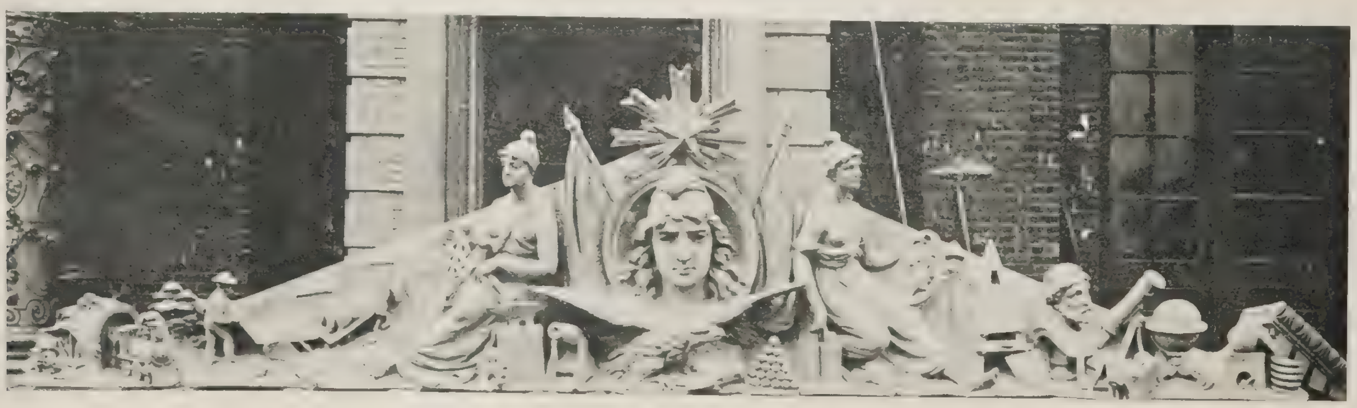
In the advertisement of The Celadon Terra-Cotta Company, Charles T. Harris, Lessee, on page xxvi, is illustrated the high school building at Kingston, Penn., of which F. L. Olds is the architect.

BARTA PRESS COMPETITION. JUDGES' AWARD.

THE gentlemen who acted as judges in the Barta Press Competition, Messrs. C. Howard Walker, R. Clipston Sturgis, and Bertram G. Goodhue, have awarded the five cash prizes as follows: First prize, $50, L. Eugene Jallode, 52 Broadway, New York; second prize, $25, Peter Brust, St. Francis, Wis.; third prize, $15, Louis Sonntag, 320 Walnut Street, Philadelphia; fourth prize, $10, Francis S. Swales, Rochester, N. Y.; fifth prize, $5, Alfred F. Shurrocks, 75 Westminster Street, Providence, R. I.

The report of the judges and the successful designs will be published in our August number. At the time of going to press Mr. Barta had not made his selection of the designs for which special prizes were offered. This list also will be published in our August number.

REGARDING the drawings published in the plate pages of THE BRICKBUILDER, we would state that they are always of buildings constructed principally, if not wholly, of brick or terra-cotta, or both. This statement is made for the reason that on many of the drawings published there is nothing to distinguish them from stone or wooden buildings. This is largely due to the fact that we use mostly scale drawings rather than perspectives. It is our purpose to publish, in connection with elevations, such details of brick or terra-cotta as we think will be of interest, although, as is generally appreciated, a building may have a very interesting treatment without being enriched by elaborate detail.



Spanish Brick and Tile Work. II.

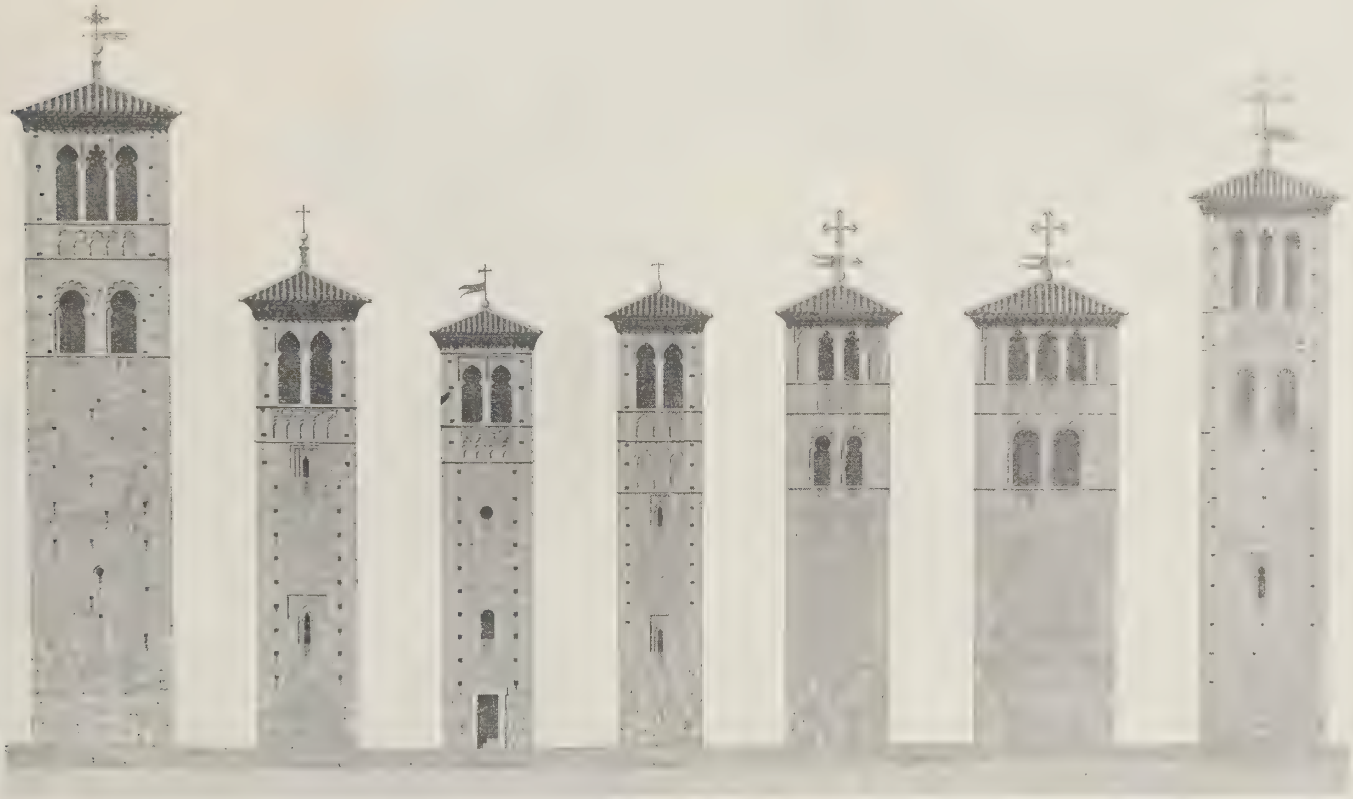
BY C. H. BLACKALL.

TOLEDO is in many respects the most fascinating city in Spain. For nearly three hundred years it was the capital of the mightiest of the Hispano-Moorish kingdoms, and when the Moors were driven to Cordova, Toledo became the center of Christian civilization, and was for centuries the first city of the land, with a population exceeding 200,000, and a vitality in art and industry which is hard to appreciate now. The Bishop of Toledo was the primate of Spain, and the arts and sciences were there cultivated to the highest point during the golden era of Spanish rule. The removal of the capital to Madrid began the work of slow decay, which has lasted ever since.

If the imaginative qualities are an important essential of good architecture, surely all architects ought to visit Toledo. The city is built on a peninsula enclosed by the Tagus on three sides. The precipitous cliffs rise abruptly from the ragged water's edge, and are connected at points to the opposite shore by picturesque bridges dating from way back into the time of the Romans. The city itself is a maze of narrow, tortuous streets, hardly one of which is wide enough for a wagon to be drawn through. The Cathedral and the Alcazar dominate the irregular mass, and scattered all through in unexpected corners and forgotten by-paths are fragments of architectural remains from the successive generations which have occupied and built over Toledo. There is very little which has been preserved intact. Nearly every monument has been restored, altered, or rebuilt at different periods, and the result is a conglomerate which has to be taken in detail in order to appreciate how much architecture has been crowded into this narrow little city at different times. Indeed, we can only faintly appreciate the magnificence which must once have been the rule in opposition to the neglect and decay which is everywhere now so apparent.

The brickwork of Toledo is almost entirely Moorish in its origin. When brick was employed by the Spaniards in later periods, it was invariably covered over with a thick layer of stucco, and brick as such is very little found in the later work. What remains of the Moorish brickwork in Toledo deserves a more careful study than it usually receives, as, notwithstanding its fragmentary and disappointingly scattered condition, it is unique of its kind. Of the works dating from the time of the Moorish rule very little remains, and even that has been so altered and built upon as to be of little actual value. The Christian conquerors doubtless made it a point of honor to destroy the monuments of their infidel foes, but the genius of the subjugated race long survived defeat and found free employment in the churches and shrines which were built for their captors. Hence we find here, as in Saragossa, that the Moorish style is expressed in the Christian churches. Indeed, this style, which the Spanish designate as Mudejare, endured even after the Moors were expelled from the country, for up to the fifteenth century nearly all of the better artisans and architects were of the fallen race.

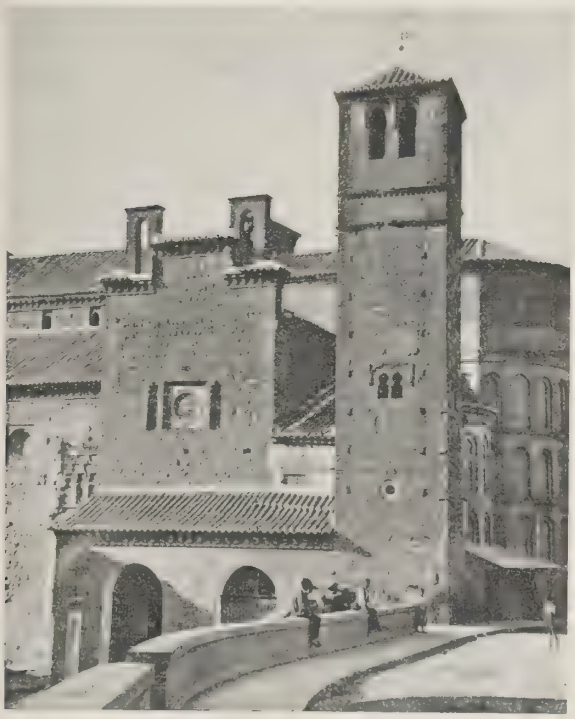
There are scattered through the city a score or more church towers in which the Moorish origin is very strongly marked. All of these are graceful in proportion and generally delicate and appreciative in detail. The accompanying illustration, showing a number of these, is taken from the superb work published by the Spanish Government, entitled "*Monumentos Arquetectonicos de España.*" In the reproduction the towers are shown in perfect condition, though they are actually in a sad state of decay. In all of these towers it will be noticed that the construction is of rubble stone bonded by regular courses of brick, and with brick quoins and finish. In none of these are the wall surfaces treated with the delightful fretted ornamentation noticed in the Saragossa towers. The brick is really used with an intelligent appreciation of constructive practicability, which is usually conspicuous by its absence in Moorish work. In these towers the scaffold holes are frankly admitted and play a considerable part in the effectiveness. The brick is deeper in tone than that used in Saragossa, although it is far from being as red as in some of the Seville buildings which we shall study next. Possibly the Moors would have plastered the rubble with white stucco. This quoin treatment combined with coursed rubble seems to be peculiar to



TOLEDO TOWERS.

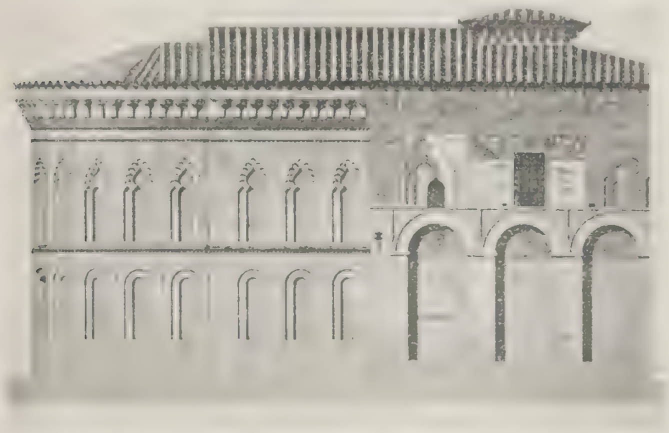
Toledo. It is certainly an essentially Spanish feature, and finds a later and more florid development in Seville, and to a slight degree in Mexico.

One of the most prominent remains is the Puerta del Sol, which was one of the city gates and is only in part of brick, the bulk of the construction being of rubble masonry, but the ornamental parts are treated entirely with brick. The design of the central motive is admirable. The driveway is small, as is the case with all of the Moorish gates, but the monumental effect is enhanced by the double horseshoe arch and enriched by the double blind arcade of brick above the center. It seems so easy to do a piece of work of this sort, when looking at the photograph, that one is naturally led to wonder why our attempts at reviving this Moorish style in brickwork have been such complete failures. The only explanation is that the connection between the construction and the decoration in Moorish work was extremely attenuated, and the design was carried out in so subtle a vein that when we undertake to apply the same motives to our present necessities, we miss the intangible bond which united the Moorish work so cleverly and makes it seem so thoroughly appropriate for its place and its functions.



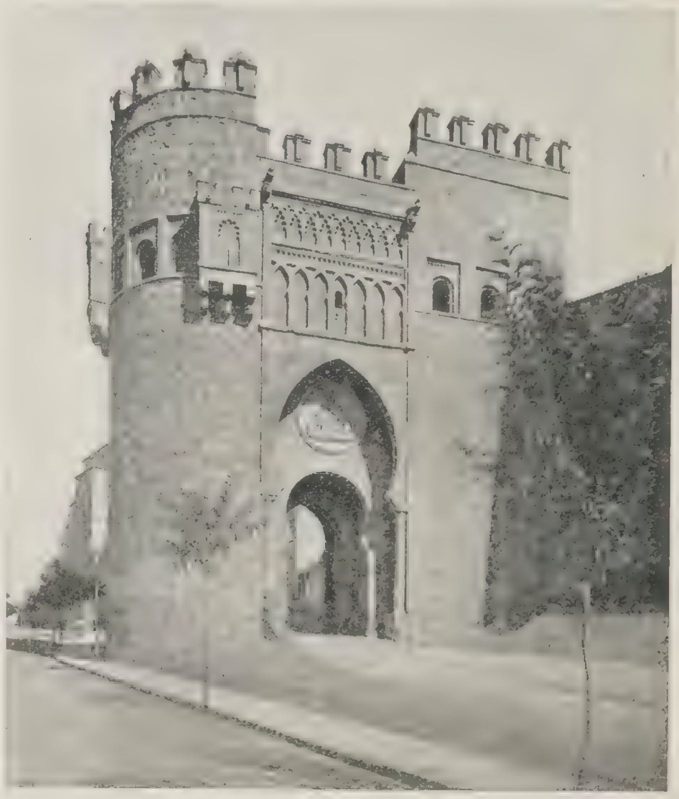
SANTIAGO DEL ARRABAL.

The Parish Church of Santiago del Arrabal is another very interesting example, dating from 1247. Here the interest lies very little in the mass, and not specially in the detail, but rather in the manner in which plain brickwork has been combined to produce an effect. The masonry is in the main of rubble, with brick quoins, brick window finish, cornices, and chimneys. The brick is laid with very heavy joints, quite as thick as the bricks themselves. The action of time has washed away a great deal of mortar from the joints, so that the wall surfaces, instead of being unbroken, are cut up by the recessing of the joints, adding very materially to the effect. The design of the gable end, with its chimneys brought in harmoniously, and the projecting tile eaves, is very pleasing and is worked out in an admirable manner. The tower is manifestly unfinished. I do not remember that this open joint effect has ever been tried in a modern building, but it offers an opportunity of escape from our stereotyped methods of brick laying which in the right hands ought to lead to very interesting results. It would hardly be successful with our ordinary brick, but with the long, flat shapes which the Moorish designers employed it would be thoroughly appropriate.



SANTO CHRISTO DE LA LUZ.

In an out-of-the-way corner of the city, close by the crumbling old city walls, is an antiquated, weather-beaten brick structure which has an interesting history. It was originally intended for a Mohammedan mosque and was built in the early period of the Saracenic domination, presenting the Arabian architecture at the time when the remains of the Roman and early Christian arts had been assimilated in a measure by the invaders. The older portions date from about 850. When the city was captured by the Christians in 1085, the first mass was celebrated in this building, which was cleansed and dedicated to Santo Cristo de la Luz. The Hospitallers of St. John held it from 1156 to 1843, during which time it was often repaired and mutilated, notably by Mendoza in the fifteenth century, though the character of the design has not been materially altered, and all the changes were carried out in the Moorish spirit, so that here are shown the earliest and the latest manifestations of Oriental Spanish architecture.



PUERTA DEL SOL.

A long visit would not exhaust the possibilities of Toledo. Diligent research would doubtless reveal many charming bits of Moorish brickwork lining up the walls of dilapidated *patios* or hidden under heavy coats of dingy stucco. Only a little is available for actual study.

(*To be continued.*)

The Art of Building among the Romans.

Translated from the French of Auguste Choisy by Arthur J. Dillon.

CHAPTER III.

CONSTRUCTION IN WOOD.

GENERAL REMARKS ON THE METHODS IN USE AMONG THE ROMANS.

WOOD had so large a place in Roman construction that it is impossible for us to pass without reviewing their methods of framing. Unfortunately, the questions concerning them are very difficult to answer; the ruins themselves furnish but few indications of the proper solutions; and manuscripts, too incomplete or too vague, throw but little light on the methods which we have the greatest interest in knowing. An enumeration of the pieces of a truss by Vitruvius, some short notices of a small number of celebrated pieces of framing, such as the bridge over the Rhine, a sketch of the bridge over the Danube, a summing up of the framing in the basilica of Fano, and the details of a Tuscan truss, and of a pent-house at Pozzuoli; such is the inventory of the documents that remain. On such foundations one cannot build a satisfactory theory, and we will content ourselves with presenting as examples some of the descriptions whose graphic translations will involve the fewest conjectures or hypotheses.

Of all the examples of ancient framing, the shelter at Pozzuoli is the one whose arrangement is the most exactly known; the description of its construction was engraved on marble,[1] and the aspect of this modest work, restored according to this inscription, seems to be as in Fig. 85.

It served to protect an isolated gate, which, being exposed on both sides, had to have both of them sheltered. Hence the sloping roof projects over both faces. All rests on the extremities of the two beams B; there is no framing, unless it is where the rafters meet at the summit and are halved together. Nothing is more logical, or even more primitive, than this arrangement, whose simplicity, none the less, is not lacking either in originality or in charm; in spite of its small dimensions, it has a certain monumental aspect that accords well with the severe and somewhat archaic forms of the architecture of the latest periods of the Roman republic.

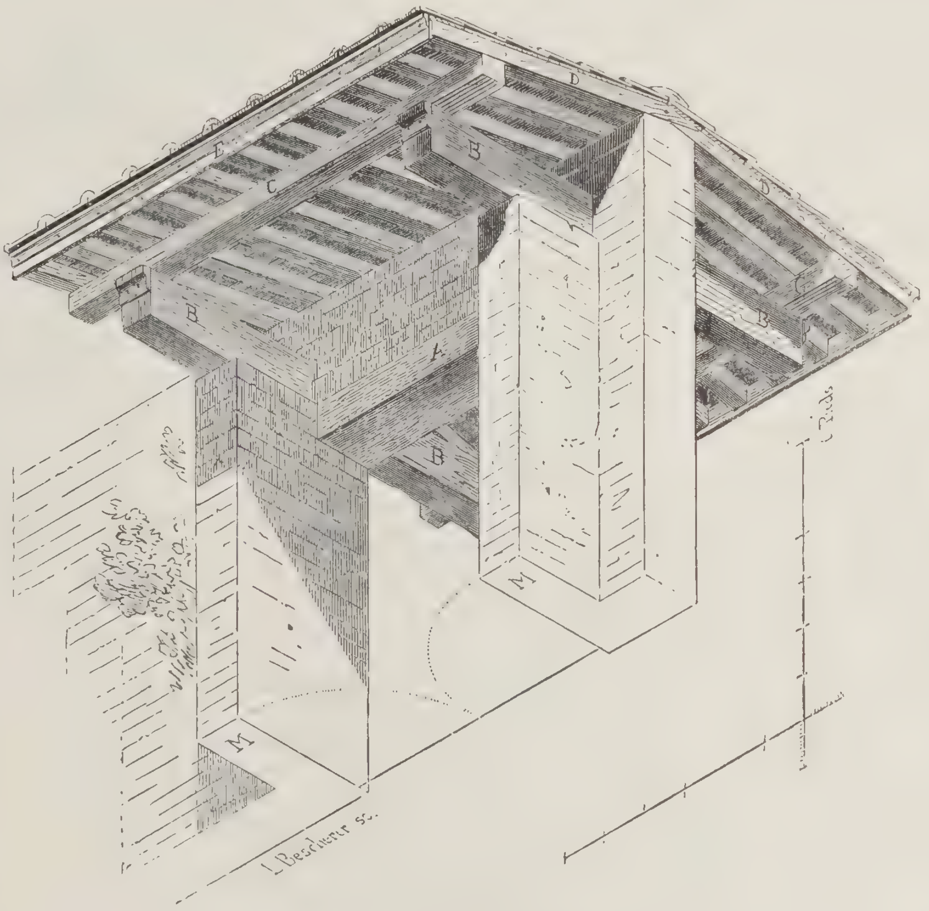


FIG. 85.

The same characteristics are still more strongly shown in the framing of the temple which Vitruvius describes under the name of the Tuscan Temple (Liv. IV., chap. 7)[2].

On the columns were placed two like beams forming the architrave; these pieces, solid in themselves, were slightly separated, so that the air could circulate entirely around them. The pediment of the temple, which was sometimes made of wood, — no doubt because of the lightness of that material, — was not directly over the columns, but, carried on the extremities of four projecting beams, overhung by a distance equal to one fourth of the height of the columns; the rule given by Vitruvius on this point is perfectly clear, "(*Mutuli*) *quarta parte altitudinis columnæ promineant.*"

None the less, the aspect that we are thus led to give to the temple differs from that ordinarily attributed to such edifices; the overhanging pediment seems to fail to conform with the received principles of architecture, and ancient editors of Vitruvius, shocked by the prominence of the projecting beams, have thought to permute the first two letters of the word *AL*titudinis, and to write: "*Mutuli quarta prate LAtitudinis columnæ promineant.*" By this sacrifice they harmonize the ancient tradition with the present usages of architecture, but the correction is doubly at fault in being contrary to the text of the manuscripts, and in disagreeing with the ordinary forms of the language of Vitruvius. Vitruvius speaks of the diameter of a column in twenty places, and nowhere calls it "*latitudo*"; the only word he uses is "*crassitudo columnea.*" Our interpretation, moreover, is that admitted by the architects of

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[1] This inscription is known as "*Lex puteolana parieti faciundo*" (Egger, "*Latini serm vetust reliquiæ*" p. 248; "*Corpus inscript. latin.*," No. 577).

A graphic interpretation of the text was given by Piranesi (Tom. VI., plate 37), and an English translation is found in the work of Donaldson, entitled "A Collection of the Most Approved Example of Doorways" (London, 1836). The two interpretations agree, and I think them exact, at least as a whole. Nevertheless, as works received as authorities — and among them the "*Corpus inscriptionum latinarium*" — do not agree with this double commentary, I thought it would not be amiss to take the matter up again, limiting myself, be it understood, to the passages relating to the art of building. Moreover, it will be an occasion of rectifying the slight errors which seem to have escaped the English translator, and of putting more plainly in several places the idea concealed by negligence of orthography, and by forms of Latin that differ profoundly from those of the classic writers; I have profited in this revision by the explanations of one of the best authorities on the ancient Latin tongue, M. Egger.

". . . The place situated beyond the public road is separated from it by a wall; the contractor is to form a gate at the middle of this wall, which shall be seven feet high and six feet wide.

"Against the wall he shall place two antæ, MM., two feet wide and one foot thick.

"Above the opening he shall place a lintel of oak, A, eight feet long, one and one quarter foot thick, and three quarters of a foot high.

"On this lintel, and in line with the antea, he shall place in projection (*pro-icito*) two corbels of oak, B, two thirds of a foot thick, one foot high, projecting four feet beyond the wall on each side; and at the extremities of the corbels he shall nail painted doucines.

"On the corbels he shall place two small beams of fir, C, measuring one half of a foot on eace face, and shall fasten them with nails.

"He shall place rafters of sawed fir measuring one third of a foot on each face, spaced not more than three fourths of a foot apart, and carrying a sheathing of fir made of planks one foot wide.

"At the extremities of the rafters he shall fasten bandeaux of fir, E, three quarters of a the Renaissance, whose taste does not seem to have been wounded by this unaccustomed projection. In order to convince one's self of this, it is only necessary to look at the drawing of the Tuscan Order and its accompanying notes in the original edition of Palladio (edition of Venice, Liv. I., p. 19).

Finally, there is left to us the sculptured imitations of ancient framing; the tombs of Lycia continually recall the forms of the wooden construction used by a people whose relationship with Etruria is well enough known. And everywhere in these sculptured copies of wooden temples we find overhanging pediments. The work of M. Texier on the ancient monuments of Asia Minor offers on every page proofs of this assertion. It is sufficient to cite what are perhaps the most remarkable examples, the tombs of Telmissus (pl. 176) and of Antiphellus (pl. 201). At Antiphellus, the projection of the pediment, as indicated by the figures given by M. Texier, is 0.950 m. to a height of 2.077 M.; this proportion is, I believe, the best possible commentary on the text of Vitruvius.

Let us admit the existence of these overhanging pediments as certain; it is too logical to be denied. Thanks to their projection, corresponding to that of the overhanging eaves, the rain was prevented from beating against the foot of the building on all sides, and in ordinary weather it gave a pleasant shade. The eaves and the pediments together formed a covered gallery around the whole temple, rendering all the services of an exterior portico, without its expense and incumbrance. Thus the arrangement of the framing of a Tuscan temple seems equally advantageous, whether it is considered from the point of view of utility, or of the preservation of the monument.

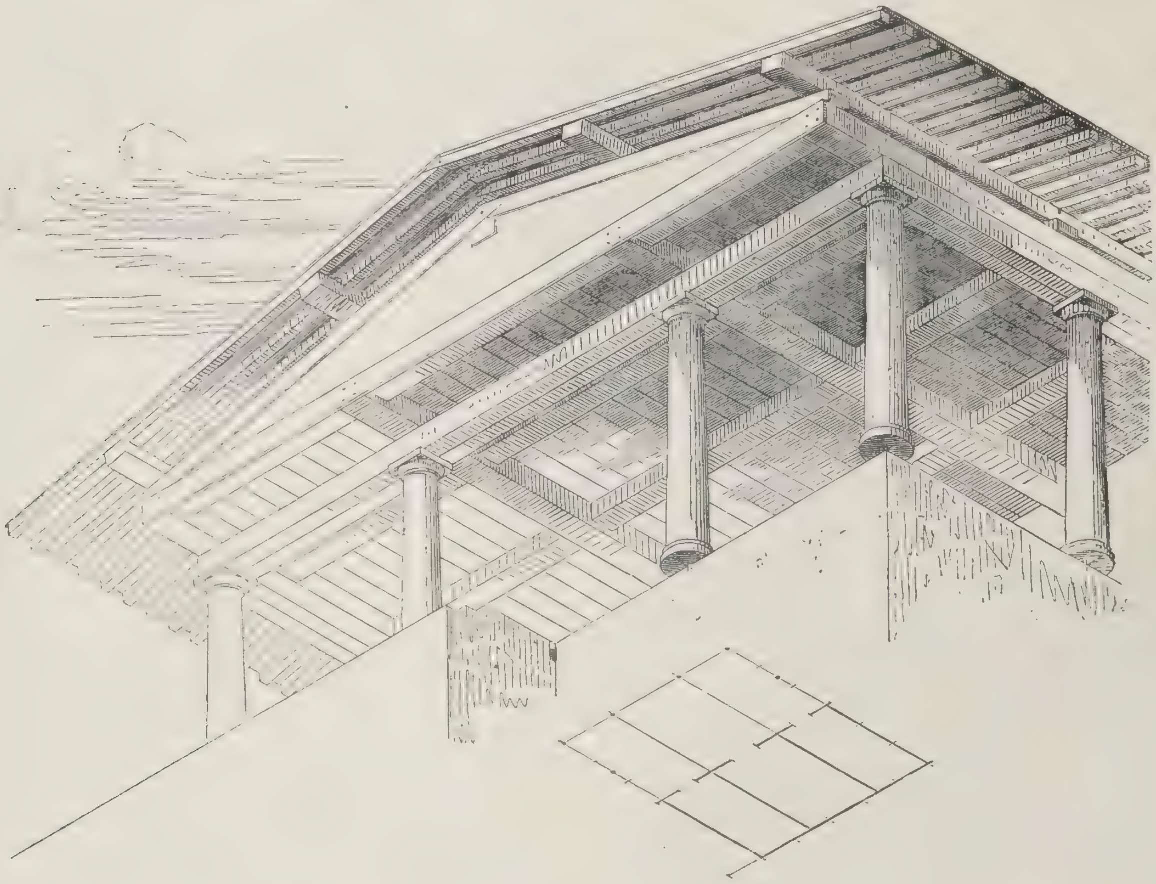

FIG. 86.

This type of construction, in use at the time of Vitruvius, is related, as its name indicates, to the models of ancient Etruria; and it is doubtless not the only instance where the Romans followed the Etruscans in the matter of framing. Nowhere do the traditions of the art of building seem more persistent than in wooden constructions; and it would surely make this question itself clearer if the methods of the Etruscans were brought to light. We have the complete types of roofs in the carved imitations on the Etruscans' monuments; to cite the entire series would be to review the whole of the subterranean constructions of this remarkable people, so I have chosen but two, which seem to me to be the most remarkable of all on account of the clearness of the interpretation, and because of the judicious combinations which they show. Fig. 87 is one of the examples; it is the caissoned ceiling of one of the tombs cut in the tufa in the necropolis of Chiusi.

Here can be recognized, in proportions which the difference of material has hardly altered, a faithful imitation of a ceiling of wood. Copied line for line, suppressing the quarter rounds and the fillets, which evidently are planted moldings, this ceiling is reduced to a system of rafters crossing alternately, something like the roofs of trunks of the trees used in the buildings of Cœlies, of which Vitruvius speaks (Lib. II., Cap. I.), or like the roofs of fir trees laid horizontally, such as are seen in the wooded parts of the Alps.

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foot wide and one and one half inches thick, and on this a cymatium, all fastened with finishing nails.

"He shall cover the two slopes with tiles; there shall be six rows of tiles on each slope, and the first row shall be fastened to the bandeau E. That is, he shall place a covering over the gate.

"The same contractor shall make and place, furnished with all ironwork and soaked in pitch, two gates of lattice with uprights of green oak, as in the gate near the Temple of Honor."

"For the mason work (*quod opus structile fiet*): —

"The earth (that is, the puzzolani) shall be mixed with one quarter of slaked lime.

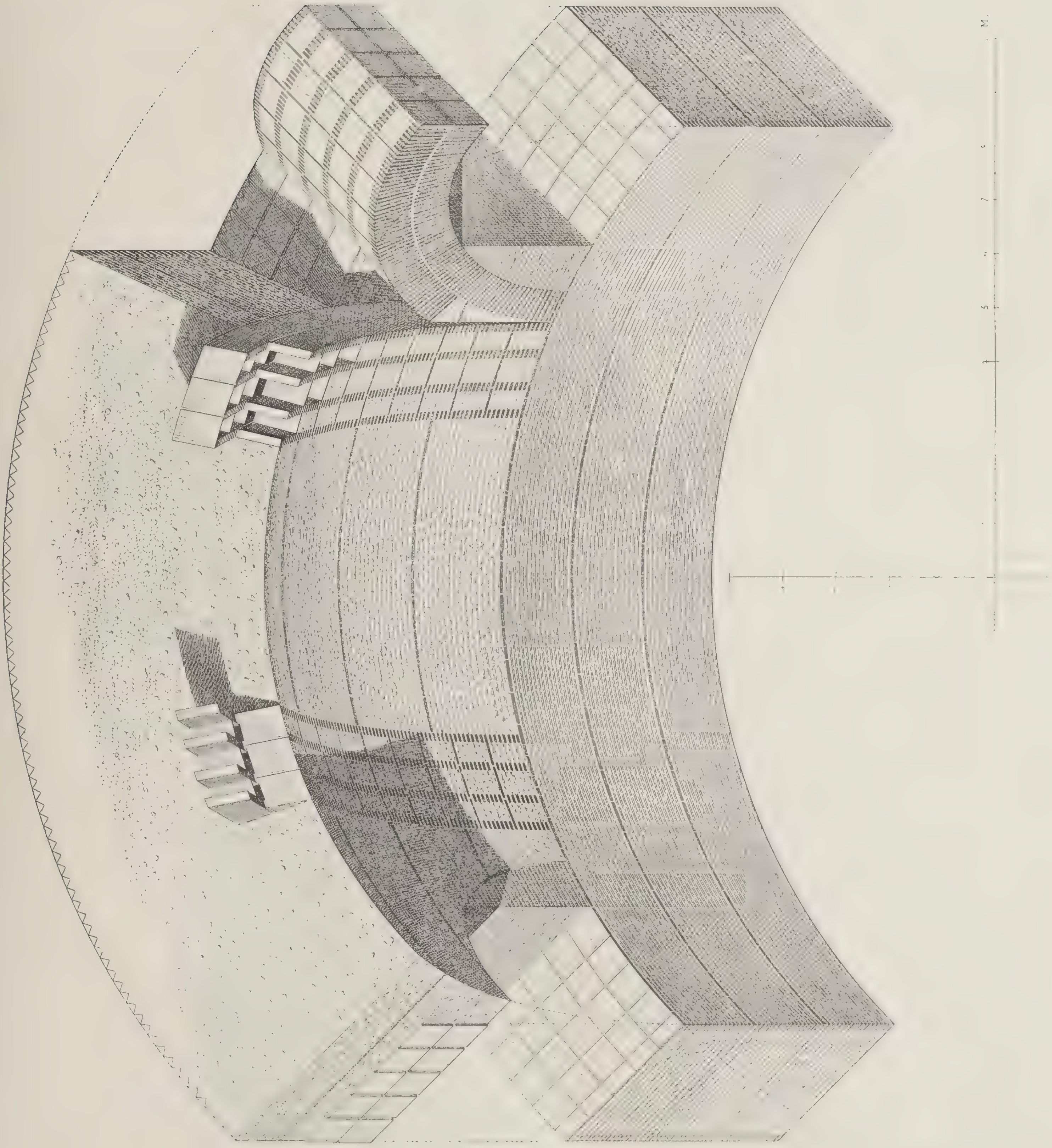
"He shall use for the rubble no stone that weighs dry (this is an allusion to the practise of wetting the stones before setting them) more than fifteen pounds, and shall use no cut stone more than four and one half inches high.

(Here the inscription runs "*Nive majorem cæmenta struito quam . . . nive angolaria altiorem* . . . "This should be read as though the letter *m*, the final of the words *majorem* and *altiorem*, was omitted; this is a frequent fault in epigraphic texts.)

"The work shall be completed on the next calends of November, C. Blossius contractor, for the sum of 1,500 sesterces."

[2] After having said in the clearest terms that a double beam (*trabes compactiles*) shall be placed on the columns as an architrave, separated by an interval of two fingers, in order to be safer from rotting, Vitruvius continues in these terms: —

"The corbels, placed on these beams parallel to the partition walls, shall project (*projicantur*) by a quantity equal to one quarter of the height of the columns. Their extremities shall be ornamented with bandeaux, and above these bandeaux shall be the pediment either of wood or of masonry. Finally, above the pediment, the roofing (*columen*), the rafters (*cantherii*), and the purlins (*templa*) shall be placed so as to give a projecting roof equal to one third of the roof itself."



THERMES D'AGRIPPA.

PLATE X. THE ART OF BUILDING AMONG THE ROMANS.

All the pieces are halved together; but nowhere are they appreciably weakened by their assemblage, for nowhere has the builder cut into a rafter near the middle of its span; if a rafter is cut into in assembling, it is always near its extremities, and thus the joining of the pieces is so arranged that the least possible amount is taken from their rigidity.

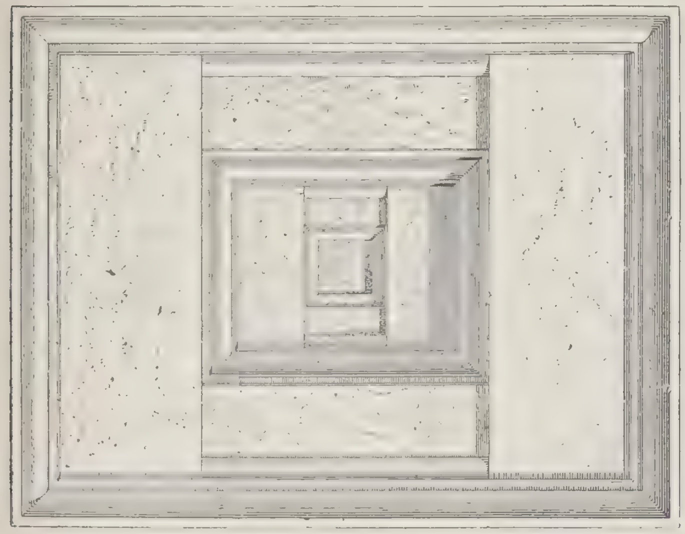


FIG. 87.

Another room of the same tomb has an imitation of woodwork whose forms are still nearer modern ones, but where the same spirit is manifested with a more perfect evidence. I give its general appearance in Fig. 88. Each of the caissons of which it is composed recalls that shown on the preceding figure (Fig. 87); there is the same care taken in the one as in the other to place the mortises near the ends of the pieces; there is the same general aspect and the same decorative effect. In both cases one sees at the same time the recollection of the framing itself and of the ornaments with which the ancients were accustomed to enrich it. The moldings were nailed into the reentrant angles after the framing was finished, a custom which seems to have been preserved by the Romans; for by a remarkable coincidence, it is precisely by means of such planted moldings that the *Lex puteolana* (see preceding foot-note) prescribes the decoration of the rafters and girts of the shelter: "The contractor shall nail a doucine on the bandeaux," and elsewhere; "at the extremities of the rafters the contractor shall fasten with nails painted doucines"; thus was expressed, a hundred years before our era, the contract of Pozzuoli; and such was the Etrurian framing contemporary with the tombs of Chiusi.

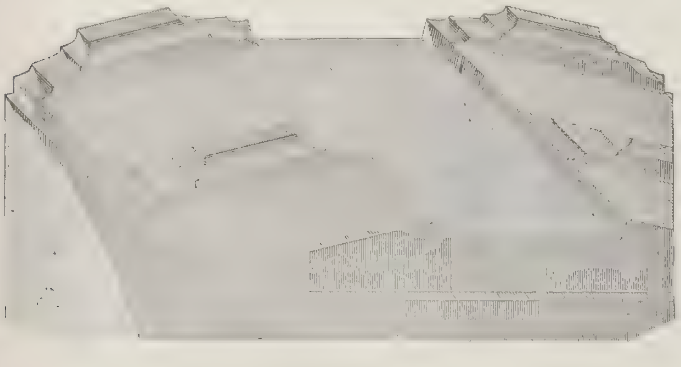


FIG. 88.

The rafters, as shown in the last figure, are very close together, and the intermediate pieces make the space so small that it could be spanned by tiles, or better, as is still practised in the same country, by an intermediary paving of bricks between the rafters and the tiles of the roof. The bottom face of the bricks forming the bottom of the caissons remained visible; they could be decorated with enamel or paint, and the rafters, covered with the violent colors that the Etruscans knew how to harmonize so well, gave to the composition a richness full of elegance.[1]

Here is a last detail of Etruscan framing, brought down to us through Vitruvius. It was a question of covering the portico or cloister which surrounded the atrium of ancient dwellings.[2]

"In the Tuscan *cavædium*," he says, "horizontal pieces, AB and CD, resting on the walls of the court, support the transverse rafters (*interpensiva*) EF and GH; the corner rafters run from the angles of the court to the angles of the main beams, and the rafters slope towards the central basin." This description permits us to restore the roof, as in Fig. 89. The solution is evidently applicable only to a court of small size, in which case it permits the sheltering of the sides without encumbering the passages by isolated supports.

If now we examine together the Roman or Etruscan framing shown in the last five figures (85 to 89) from the same point of view, we will perceive in the diverse combinations a common physiognomy, a family likeness, as it were. Those large pent-houses, as we might call them, the projecting roofs of the Etruscan temples that overhang by an amount equal to one third of the height of the columns, the shelter at Pozzuoli that projects beyond the wall by a half of the height of the door that is protected by it, the care taken for the preservation of the timber, either by separating the doubled beams or by keeping the mortises near the extremities; all these things seem scattered details, too insufficient to allow us to restore the complete picture of the art of framing among the ancients; but they at least indicate its spirit and its tendencies. The great projection of the roofs was logical under a burning sky, and their slight slope seemed appropriate to a country where snow was rare; but the Romans, I believe, committed the error of applying this form of roof to our Northern countries, for which it was not suitable. This was one of the rare instances where they extended their methods with their power, without regard for the variation in climate. They covered the unvaulted halls of the Baths of Paris as they would have covered a temple or a basilica at Naples,[3] and this unfortunate example was imitated in the architecture of the Northern provinces long after the fall of the Roman Empire; its influence lasted until the middle of the twelfth century, and is still felt in our day. But let us go back to the Roman constructions.

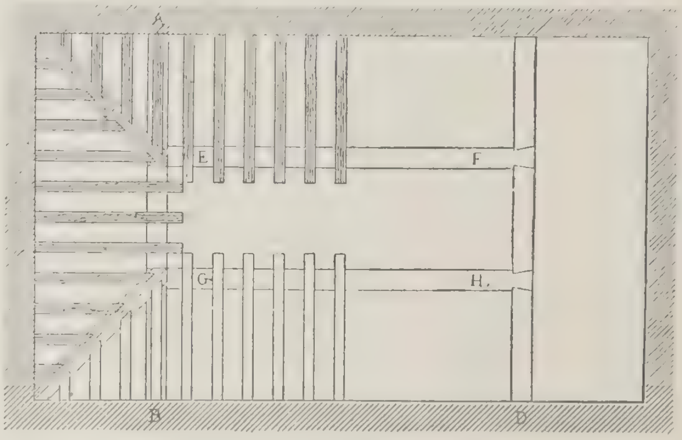


FIG. 89.

(*To be continued.*)

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[1] In Figs. 87 and 88 the backgrounds were white, the beams red, and the moldings black.

[2] The restoration in Fig. 89 corresponds exactly with the one given by Mazois in his work on the ruins of Pompeii (Part II., plate 3).

[3] It must be recognized, however, that this custom, though everywhere the dominant one, was not entirely exclusive. The ancients, besides the tiles with long run whose fragments are to be seen in all our museums, used flat slabs, laid to lap, which exacted a slope much less pronounced. We have a sculptured imitation of them in the conical roof of the Mausoleum of St. Remi; it is apparently this kind of roofing that Pliny refers to, designates under the name of "*pavonaceum tegendi genus.*" (*Hist. Nat.*, Lib. XXXVI., Cap. XLIV.) — The roofing of shingles (*scindulæ*) was, morever, much used by the ancients. It was used principally in Gaul, and evidently with it steeper slopes were necessary than those of the Romans. (See Plin., *Hist. Nat.*, Lib. XVI., Cap. X.; Cf. Vitr., Lib. II., Cap. I.).

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

FIRE-PROOF FLOOR ARCHES.

BY GEO. HILL, C. E. (*Concluded.*)

CLAY ARCH TESTS.

Test No 96.— This was of a 12 in. end-construction hard tile arch, similar to the preceding, eccentrically loaded, the center of the load being placed 18 ins. from the center of the web of one skew-back beam. When the load was placed on this arch the voussoirs at the left-hand side under the point of application of the load slipped past the key block, fracturing and splintering it. Increased pumping resulted in no increase in the pressure. The maximum load was 3,800 lbs. After it was found that no gain in pressure could be made and that the plunger had gone almost the full length of its travel, the load was discontinued and many of the voussoir blocks were found to be intact except for splintering on the edges. Arch after failure shown in Fig. 51.

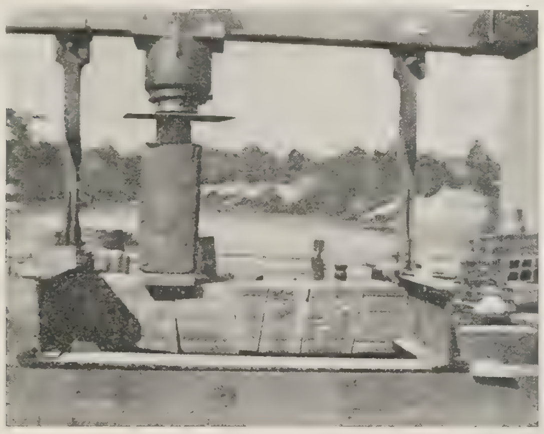


FIG. 51.

Test No. 97.— This arch was of the 8 in. side-construction hard tile plain skew-back type. It was loaded eccentrically with the center of gravity of the load placed 18 ins. to the right from the left skew-back beam, and failure occurred by the shearing of the top web at the left-hand edge of the load block, as is shown in Fig. 52. The maximum load of 1,500 lbs. was reached in 1.2 minutes.

Test No. 98.— This arch was similar to No. 97, but centrally loaded. Failure occurred by the collapse of the voussoir next to the key at the left-hand end, or under the edge of the point of application of the load. The balance of the arch remained intact. The maximum load of 2,500 lbs. was reached in 2.7 minutes.

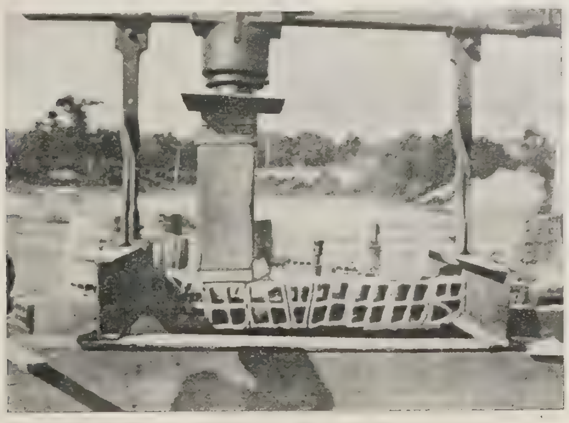


FIG. 52.

Test No. 99.— This was made on an arch two courses wide, of blocks similar to those of Nos. 97 and 98, with about 1½ ins. of sand covering them; the bearing blocks were 18 ins. wide, 4 ft. 4 ins. long; the lower edge of one skew-back broke off at 9,950 lbs. Continued pumping resulted in a decrease in the pressure to 2,500 lbs., and then the second course tumbled in. Fig. 53 shows how the left-hand skew-back failed by shearing down at the point of junction of the curved rib with the vertical and horizontal portions. This skew was the only part of the course that was injured, which can be seen in the illustration.

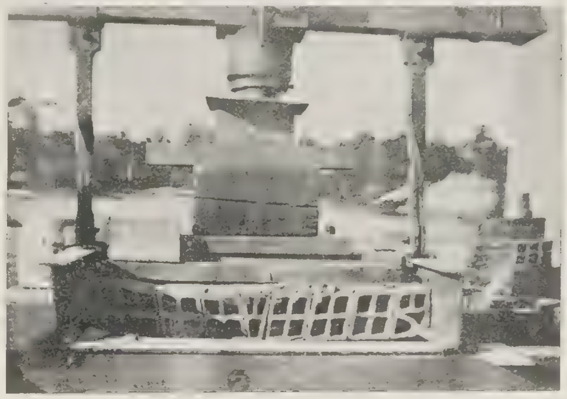


FIG. 53.

Test No. 100.— This was similar to No. 99 in all particulars; the loading was on a plank 10 ins. wide and 2 ft. long, centrally applied. At 2,000 lbs. the bottom began to open and there was a little crushing at the crown; at 2,500 lbs., reached in 3.4 minutes, the

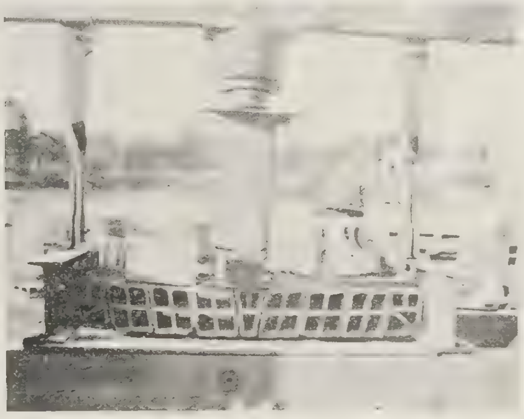


FIG. 54.

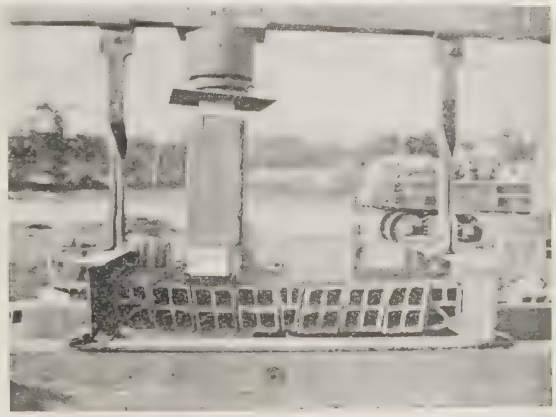


FIG. 55.

voussoirs next to the point of application of the load to the right and the one north of it both crushed in, letting down both courses (Fig. 54).

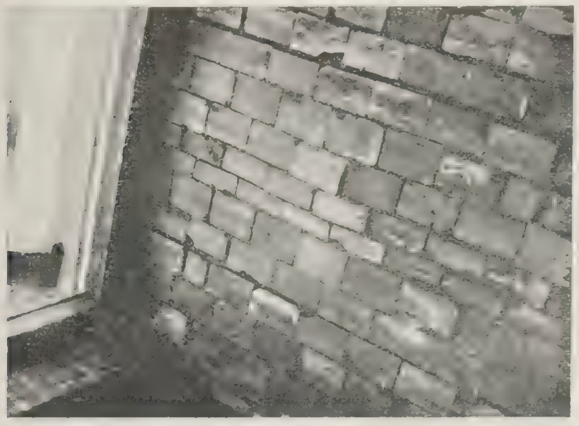


FIG. 56.

Test No. 101. — This test was made on two courses arranged as in Test 100, and eccentrically loaded. At 1,250 lbs. one of the voussoirs east of the west skew-back cracked through on the edge near the top. At 2,000 lbs. it was cracking off in slivers. When failure occurred, the top voussoir collapsed just to the right of the left skew-back. The voussoir immediately under the load also fell in at the point of fracture. The maximum pressure was 2,750 lbs., reached in 2.5 minutes (Fig. 55).

The final series of tests were made recently at the Ireland Building, of commercially constructed fire-proof arches under various forms of loading and points of application thereof. The arches were in all cases 8 in. side construction, hard tile protection skews of 50 in. span. The form of loading employed is shown in Fig. 29a for concentrated load, whether centrally or eccentrically applied, Fig. 61 for a distributed load.

The method of cribbing shown consisted in using 3 in. by 4 in. yellow pine sticks, 1 in. apart in the clear, decreasing in length and giving a true condition of uniform loading. This was demonstrated by series of levels taken throughout an entire test, showing that the arch curved uniformly over its span. The only peculiarities in the form of failure are shown as follows: —

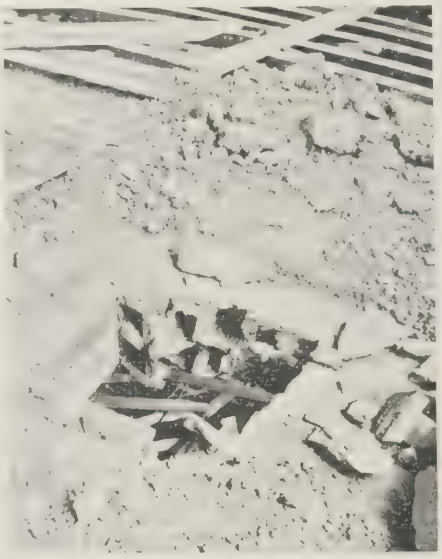


FIG. 57.

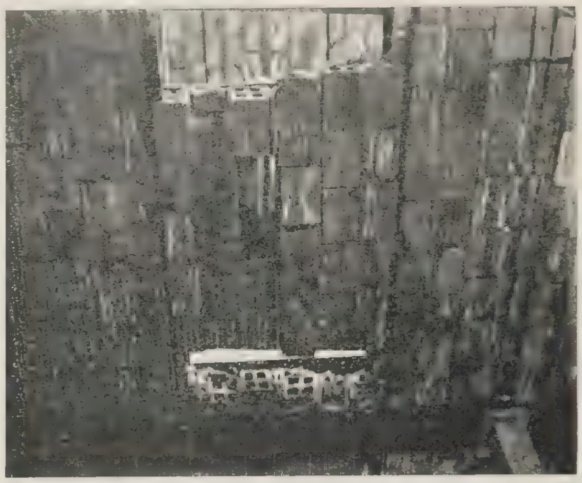


FIG. 59.

Fig. 56 is a vertical upward view showing the block broken under point of application of the load of Test 101.

Fig. 57 shows the way in which the blocks failed under the point of application of the load, Test 104; the view being from above, and showing the side of one of the voussoirs adhering to its neighbor, and another one of the voussoirs broken.

Fig. 59 shows the ceiling under the point of application of the load of Test 110.

Fig. 60 shows the diagonal breaking of the ceiling under the load of Test 112.

Fig. 58 is a view of the under side of one of the arches, which had been cut out so as to limit the length.

The results of these tests are given in Table 5 hereto appended, and will well repay study.

CONCLUSION.

Any one who is willing to analyze all of the tests made must be struck, first of all, with the very great differences shown in the ultimate resistance of the arches following all the way from practically a few pounds per square foot upwards to several thousand pounds.

This apparent discrepancy is due to the following causes: —

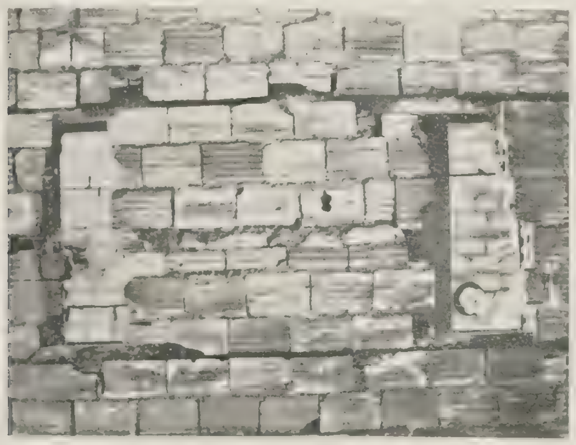


FIG. 58.

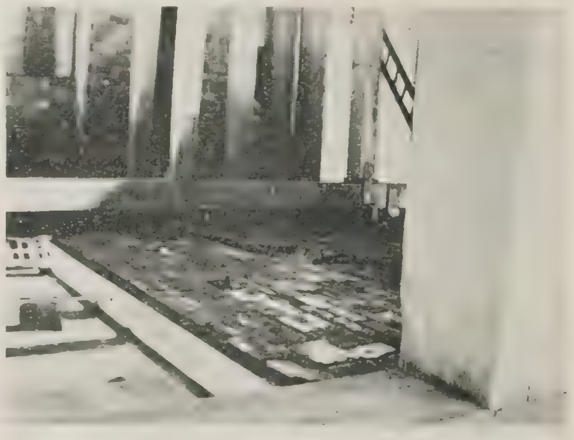


FIG. 60.

Table No. 5.

Test Number.	Width. Inches.	Total Arch Area. Square Feet.	Loaded Arch Area. Square Feet.	Total Load. Pounds.	Load per Square Foot of Arch.	Load per Square Foot Loaded.	Horizontal Thrust.	Shear per Foot Skew.	Character of Loading.	Deflection. Feet.		
102	264	9.0±	0.73	97.50	....	13.350	12.150	....	Central..........	....	Whole length of section cracked, west end of bay.	One bay.
103	264	9.0±	0.73	18.500	....	25.360	25.150	....	Central..........	....	Near center of bay, sheared down,	
104	264	9.0±	0.73	11.900	....	16.300	14.890	....	Central..........	0.039	East end of bay, loaded block crushed,	
105	264	9.0±	0.73	10.000	....	13.700	12.500	....	Central..........	0.025	East end of bay, north of 104,	One bay.
106	264	9.0±	0.73	13 500	....	18.500	16.880	....	Central..........	0.083	Middle of bay, north of 103,	
107	264	9 0±	0.73	14.500	....	19.860	18.130	....	Central..........	0.12	West end of bay, north of 102,	
108	54	18.72	0.73	9.000	481	12.330	11.250	1000	Central.........	0.08	North of 107, cut section.	
109	48	16.64	0.73	10.000	602	13.700	12.500	1250	Central..........	0.036	North of 106, and east of 108, cut section.	
110	48	16.64	0.73	6.000	361	8.225	7.500	750	Central..........	0.078	North of 105, and east of 109, cut section.	
111	264	9.0±	10.55	20.000	....	18.95	50.000	....	Distributed.......	0.034		
112	264	9.0±	10.55	25.000	....	23.66	62.500	....	Distributed.......	0.051	South of 111, affected section 6 inches long.	
113	54	18.72	9.75	11.500	614	11.80	28.750	1280	Distributed.......	0.115	Cut section, open bay, south side, skew sheared.	
114	48	16.64	10.28	17.000	1020	16.55	42.500	2126	Distributed.......	0.068	North of 113, cut section, forced down on center.	
115	48	16.64	10.28	12.500	752	12.15	31.250	1565	Distributed.......	0.038	West of 114, cut section, forced down on center.	
116	48	16.64	10 28	15.500	933	15.10	38.750	1940	Distributed.......	0.065	South of 115, cut section, skew failed, deflection showed true curve to bottom.	
117	264	9.0±	10.28	22 500	....	21.90	56.200	....	Distributed.......	0.16±	Skew sheared next open bay.	
118	264	9.0±	10.	15 000	....	15.00	37 500	....	Distributed.......	0.018	South of 117, west of 111.	
119	264	9.0±	0.73	8.000	....	10.900	10.000	....	Central...... ...	0.026	West of 118, cinders removed.	
120	264	9.0±	9 75	17.500	....	18.00	43.800	....	Distributed.......	....	West of 118, cinders removed.	
121	48	16.64	10.28	9.500	570	9.25	23.775	1188	Distributed.......	0.08	West of 118, cinders removed at skew sheared.	
122	48	16.64	0.73	4.100	216	5.620	5.130	513	Central..........	0.33	West of 118, cinders removed at skew sheared on under side.	

(*a*) Defective design, which the manufacturers of tile arches have by experience outgrown some years since.

(*b*) Tests of individual blocks without cement joints to determine the strength of the block alone, the need for cushioning, or the effect of distribution, the tests being of a laboratory nature and intended to assist the designer of blocks rather than the user.

(*c*) The difference in the character of the mortar, age, and width of block intended as a guide for the use of blocks in particular locations, or to indicate the length of time that the centers should be left in position.

A further study will demonstrate the following results: —

First. Considered purely as a matter of strength, hard tile is stronger than porous terra-cotta.

Second. Considered as a question of resistance to shock, porous terra-cotta is stronger than hard tile.

Third. The protection skew of a side-construction arch, as they are often constructed, is always a source of weakness, causing failure at the skew-back, as shown by Fig. 40. The proper form is that shown in Fig. 38; in other words, the lower member, which is the one that transmits the thrust of the arch to the skew-back, must come well within the supporting surface of the skew-back, and must also be thoroughly backed up, as otherwise the thrust will rupture the skew-back block.

Fourth. In arches of the same span the strength varies as the square of the depth.

Fifth. In arches of the same depth, the strength varies directly as the length.

Sixth. Where the ratio of depth to length approaches one to eight, the skew-back beams at the beginning and end of all tiers must be tie-rodded very thoroughly, as they will otherwise cause the failure of the arch by the kicking out of the skew-back.

Seventh. The thrust from an arch can be directly calculated from the formula usually accepted, the rise being taken at 1¼ ins. less than the distance from the bottom flange of the skew-back beam to the top of the arch.

Eighth. Commercial arches have their strength very much increased by a cinder filling, even though the filling may not be of good concrete.

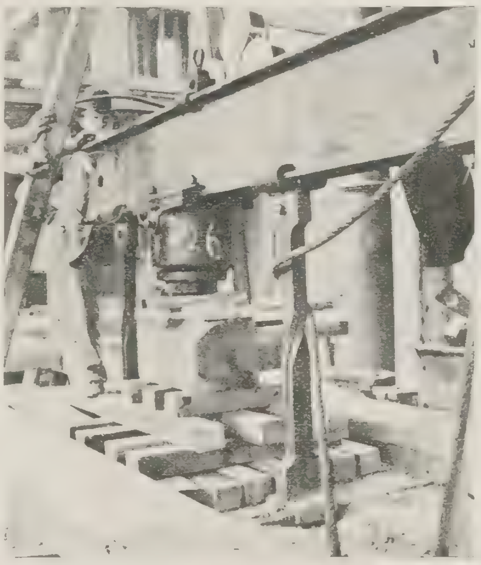


FIG. 61.

Ninth. Commercially, it is cheaper to employ an arch of the full depth of the skew-back beam than to fill the voids between the top of the arch and the top of the beam with cement.

Tenth. A stronger arch is secured by using the deep block than by using a shallow one, and the load on the floor is decreased.

Eleventh. For all conditions of use of floor arches where the anticipated loads are under 150 lbs per square foot total dead and live, either end or side construction, arches may be used, and the character of mortar required is not of importance. For loads exceeding 150 lbs. per square foot, end-construction arches should always be employed, and, as the loads increase, the character of the mortar should improve until at about 400 lbs. per square foot the very best Portland cement mortar should be employed.

Twelfth. The greatest strength is attained with the least material when the arch blocks are formed with simple rectangular cells of the usual form.

Thirteenth. Specifications which require a certain ultimate strength of block must designate exactly the conditions under which the tests will be made, specifying composition of mortar, length of span, area of arch to be tested, number of arches to be tested, and every other detail, since the absolute resistance of 1 sq. ft. of an arch is greater when 100 sq. ft. are around it than when there are but 5 sq. ft.

Fourteenth. Some form of testing apparatus similar to that employed by the author must be employed for anything like satisfactory results.

Fifteenth. It is desirable that all tests made should be recorded and as many made as possible, in order to have a greater number of tests on which to base conclusions. It may be that with more extended series, similar in character to those given in Table 5, we can devise a form of arch and especially a form of joint for end-construction arches which will be more economical of mortar, quicker to erect, and, therefore, will give more uniform results. The weak point in the end-construction arch at the present time is that it requires an excess of mortar, and usually results in a concentration of the load on points of the clay which start failure. The burning of the clay inevitably warps it, and thus makes it difficult or practically impossible to employ any form of socket brick to make the joint with. But for commercial purposes the strength of the usual forms is ample.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING.

EARLY in the present century, several mechanical contrivances were introduced, designed for the purpose of measuring the values of cements.

Conclusions were sought to be reached by subjecting samples of cement, mortar, and concrete to various tests, among which may be named the needle or penetration test, the transverse, adhesive, compressive, torsional, and tensile strain tests, and in later years came the boiling and freezing tests.

The needle test, invented by M. Vicat, was perhaps one of the earliest, if not the earliest, method employed.

General Totten employed the needle test at Fort Adams, Newport, R. I., for several years prior to 1830, and soon thereafter employed the transverse test.

It may be stated that the needle test was practised to determine the time in setting, and the relative hardness attained at stated intervals during the process of hardening of the cement samples.

As this test did not indicate the ultimate strength of a cement, or a cement mortar, it soon gave place to the transverse and the adhesive tests.

General Gillmore employed the needle, the transverse, the tensile, and the adhesive tests prior to 1860.

Briefly, these tests may be described as follows: —

The relative hardness of the samples at stated intervals during and after the process of setting was measured by the penetration of a steel point or needle impelled by the impact of a falling body.

The transverse test consisted in the molding of cement or cement mortar into prisons or bars usually 2 ins. by 2 ins. by 8 ins., under pressure, which, after setting, were placed in water, and after a specified number of days had elapsed were broken by being placed on supports 4 ins. apart, and a pressure brought to bear midway between the supports.

The adhesive properties of a cement were measured by cementing bricks and blocks of stone together in pairs under pressure during the time of setting, and afterwards drawing them apart by a force applied at right angles to the plane of the joint.

The tensile test was practically the same as that now in vogue; the form of the briquettes, and the machines for conducting the tests named, have changed considerably, but the principles involved are practically unaltered.

The transverse and compressive tests are still occasionally resorted to, but the torsional and adhesive tests are no longer practised to any extent.

Between 1850 and 1860, the mode of testing cements by means of the tensile-strain testing machines gained largely in public favor in France, and was soon followed by a like tendency in England.

It was adopted by the Metropolitan Board of Works in London in 1859, and under the supervision of Engineers Grant, Bazalgette, Colson, Mann, and others soon became considered as a valuable adjunct in the determination of the qualities of the various cements offered on that work.

From that time until the present, the tensile-strain method of testing cements has constantly grown in public favor, and has become the universal practise among engineers, architects, and manufacturers.

Why this mode of testing the strength of cements and cement mortars survived almost to the exclusion of the others, it is hard to determine.

It certainly cannot compare with the transverse test for simplicity of machinery or accuracy of results.

In the formation of the samples to be tested for the transverse tests, the prisms, being straight, uniform bodies, could be readily subjected to any predetermined pressure, and the density of the prisms be gaged to a degree of uniformity unattainable in the modern briquette.

Cement testing, although practised now much more than formerly, is still far from being reduced to any fixed system of rules.

Each engineer or architect is a law unto himself, and United States engineers even do not seem to be governed by any one standard, and it would be difficult to find a brand of cement which could fulfil all the requirements of the various specifications which are from time to time given out to the manufacturers.

Thus, for example, one set of specifications states that "the cement must be freshly burned," but, "must not take less than twenty-five minutes to bear the light wire, that is, a weight of four ounces on a wire one twelfth of an inch in diameter."

Now nearly all of our best brands of rock cements will bear the light wire in about one half of the time specified, if tested when fresh, but will fulfil the requirements if they have had time to season.

Much also depends on the amount of water used, as the initial set can be retarded by a trifling addition of water, or hastened by using just enough to enable the cement to be molded.

But in this, as in many other matters connected with the testing of a cement, the manufacturer has nothing to say. He is at the mercy of the engineer, and engineers who are willing to accept suggestions from the manufacturers are not as thick as autumn leaves in Vallombrosa.

It is certain that all the best brands of rock cements in this country are improved by one or two months of seasoning, and all this that we read about, to the effect that rock cements must be used immediately after manufacture, lest deterioration may set in, is arrant nonsense.

The author is familiar with every brand of rock cement produced in this country, and he does not know of one brand that is not improved by one to two months' exposure.

The manufacturers understand this, for, to learn the value of seasoning, they have but to set aside a tightly closed package filled fresh from the mill spout, and take some from the same grinding and spread it in a dry place where the air has free access to it, and at the end of thirty or sixty days test both samples.

And yet they are daily confronted with specifications stipulating that the cement must be freshly burned.

Some of the very best brands of rock cements in this country are vastly improved by four months' exposure, if kept on floors high enough from the ground to preclude the possibility of the absorption of moisture from below.

A rock cement which is not improved by an exposure of from thirty to sixty days can hardly be considered a strictly first-class cement.

There are several of our best brands of rock cements that are naturally moderate in setting when given even a brief exposure, yet when tested fresh, will take a rapid surface hardening and give every appearance of being naturally quick setting; but an examination of the fracture of briquettes made from such cements will disclose the fact that at twenty-four hours crystallization has barely commenced, thus giving evidence of not too rapid setting. Still the superficial hardening, due to freshness, will cause them to bear the light wire too soon to bring them within the specifications.

In this way it oftentimes happens that a really first-class cement may be rejected because it sustains the light wire too soon.

The author has seen a fresh cement rejected because it bore the wire too soon, and the sample set aside, and after a few days had elapsed, tested again from mere curiosity, and found to be slow enough to come within the specifications.

During the few days of exposure the peculiarity noted had entirely disappeared.

(*To be continued.*)

EDITORS BRICKBUILDER:

In the June number of your most excellent journal, I note in the "Mortars and Concrete Department" an article signed by Spencer B. Newberry, in which it is stated, "The same result will doubtless be reached here as has been reached in Germany; namely, the complete replacement of the common natural-rock cements by artificial Portland."

This opinion has from time to time been expressed by different writers, all of whom are, or have been, engaged in the manufacture of Portland cement.

While the statement is practically true as to the cement industry in Germany, yet it is so for the very good reason that there are no really first-class cement rock deposits in that country, and not one in all Europe that can compare with the many wonderful cement rock formations in this country.

In the cement department of "Mineral Resources of the United States" for 1894, on page 581, we find the following passage, written by Spencer B. Newberry: —

"The battle between natural-rock and Portland cements has been fought out in England and Germany, and has resulted in the complete victory of Portland, and the practical disappearance of the natural-rock cement industry. The result in this country can hardly be so decisive, as most of the natural-rock cements produced here are certainly greatly superior to the Roman cements formerly made in Europe."

Although this last quotation from the pen of Mr. Newberry was written a year or more earlier than the first one, it is considerably more quieting and soothing to the nerves of an ordinary rock-cement manufacturer, for in this quotation he admits that most of the rock cements here are greatly superior to those of Europe, and that the battle in this country can hardly be so decisive in favor of the Portlands.

I am not given to writing letters for the press, and am not accustomed to it, but in this instance I feel moved to contribute a few thoughts to THE BRICKBUILDER, a journal I have carefully read since its first issue.

I have been engaged in a modest way in the manufacture of rock cement for many years, and what little I have in worldly goods is employed in that industry. Consequently I am deeply interested in all literature pertaining to that subject.

I have no desire or intention to enter into any discussion, much less a controversy, with the authors of the gloomy prophecies alluded to, but, as this is my first, and in all probability may be my last letter to you, I trust I may not trespass too much on your valuable space if I submit a few propositions.

1st. Would it not be more in keeping with the eternal fitness of things if some of the Portland prophets should now and then offer some evidence in proof of their assertions concerning the final disappearance of rock cements from this country?

2d. Taking "Mineral Resources of the United States" as authority on cement statistics, it appears that the rock cement output for 1880 amounted in round numbers to 2 millions of barrels; and in 1894 it had grown to the quite respectable sum of 7½ millions of barrels. During this time the total output exceeded 81⅓ millions of barrels; and without having the returns for 1895, it is fair to assume that the total output from 1880 to 1895 inclusive will crowd very closely on 90 millions of barrels.

3d. With the production of rock cement amounting to 7¾ millions of barrels, and that of the artificial product being less than 1 million barrels yearly in this country at the present time, is it not quite amusing to read the assertions by the Portland prophets that "the battle is on"?

4th. I want to enter a mild protest against the Portland prophets calling rock cement "common." It is no more common than is Portland, and the term should be resented by all manufacturers of rock cements.

Mr. Cummings, in his exhaustive papers to THE BRICKBUILDER on "American Cements," uses the term "rock cement," and occasionally "natural-rock cement," but as yet he has not called rock cement "common."

It is a name given it by the artificial cement makers, presumably for the purpose of conveying the idea that their own cements are uncommon.

So long as the Portland people persist in designating rock cements "common cements," the rock-cement people should speak of the Portlands as "mud cements," and not be outdone in the matter of courtesy by the gentlemen who only produce one barrel of cement out of every nine made in this country.

5th. In 1880 the rock-cement properties in this country were worth at a fair valuation $3,000,000. To-day, at a fair valuation, these properties are worth $9,000,000.

6th. Finally, I submit that if during the past sixteen years the output of rock cement has increased nearly fourfold, and the valuations threefold, would it be asking too much of the Portland prophets to kindly fix the date when the rock cements are to finally disappear from the American markets, and thus give our "common" cement makers a reasonable warning to stand from under.

A WESTERN ROCK-CEMENT MAKER.

THE STRENGTH OF COMMON MORTAR.

HERR BESCHETZNICK, an Hungarian expert, has been investigating common mortars, feeling that too much attention had been devoted to the higher cements by scientific men in all countries. He tried various kinds of lime, and slaked them all under the same conditions, afterwards allowing them to mature for a week. Mixtures of lime thus treated and ordinary building sand with water were then prepared, and tested after they had been allowed to set for one, three, and twelve months.

The result of the tests showed that poor limes set more quickly than fat limes, but that the strength of the latter was relatively greater when the mixtures used were poor in lime. Thus, 1 : 5 mixtures of fat lime had nearly the same strength as 1 : 4 mixtures of poor lime.

An American, A. S. Cooper, has also been investigating the question of mortars, turning his attention to the influence of the character of the sand upon them. He used sands of varying fineness and character of grain, and after numerous experiments arrived at the following conclusions, namely: —

1. Other things being equal, a fairly coarse sand, for example, one passing through a 12 in. sieve (12 wires to the mesh), and caught on a 16 in. sieve, gives mortars of higher tensile strength than do finer sands.

2. This effects of size of grain disappears with sands fine enough to pass a 40 mesh sieve and caught in a 60 mesh sieve. Sands finer than this give similar results.

3. The character of the surface of the grains is of moment. Mere sharpness of grain is not the only point to be considered, for an extremely sharp sand may have a smooth surface on each facet, and a moderately rough surface is preferable.

All the above results, namely, those of Beschetznick and of Cooper, are of direct practical value, and should be made use of by those who have to use mortar, and are desirous of employing only a thoroughly trustworthy mortar, which will stand the test of time.

It is certainly high time that the composition of the various cementitious materials used in building should be defined, and that the strengths of such materials of known composition should be ascertained, so that nothing should be left to mere chance, or to the intelligent discretion of those talented assistants to whom we alluded in our opening paragraph.— *British Brickbuilder.*

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

METHODS OF ESTIMATING.

WITHIN the past few years much has been done to improve the various systems under which the construction of buildings are carried on, and the proper relations which should exist between owner, architect, and contractor are constantly being more clearly defined and generally recognized; but so long as we are handicapped by the present method of estimating, there is bound to be friction between the various parties to a building contract. Even in much of the largest and most important work, the means by which the contractor determines the price at which he is willing to undertake the contract is a development of the methods still employed in many of our country towns, where the builder casually looks over the drawings and then " guesses " the building will cost so much. Often the guess is too high, often too low, sometimes about right, and the builder carries on his work in the faith that in the long run these differences will average themselves, and the net result will show a balance in his favor. For a proof that such is the fact, one has only to recall the familiar and stereotyped remark of a contractor who has figured a piece of work too low, " Never mind, I'll make it up somewhere else," which clearly shows that in many if not a majority of cases he does not know, until it is finished and paid for, whether a certain piece of work represents financially a profit or a loss. The method of obtaining estimates which is generally followed in this country is, for the architect to prepare drawings and specifications, the former generally consisting of floor plans, elevations, sometimes one or two sections at the scale of one quarter of an inch to a foot, and rarely details to a larger scale. With these before him, the contractor proceeds to estimate the price at which he is willing to undertake the work, and the first step is to ascertain the value of the materials called for, which is done by taking off the quantities, that is to say, determining the number of cubic yards of excavation, perches of stone in the foundation, number of bricks in the walls, pounds of iron, or feet of lumber in the frame, and so on through the various items which go to make up the construction, finish, and decoration of the entire building, or at least such part of it as the contractor is to figure on, and placing on each its proper value. Now if the drawings and specifications are complete and accurate, that is to say, if the quality, workmanship, etc., of various items are described in the specifications, and the quantity of each is shown in the drawings, then it is a simple matter for any intelligent contractor to estimate with considerable accuracy the value of the different materials themselves which will be required.

But here at the outset, and on the only part of the work which can give definite results, the contractor is often handicapped by having drawings and specifications which are insufficient to enable him to form an intelligent estimate of the quantities, and the architect usually seeks to remedy this defect by " blanket clauses " and " general conditions," which add to the already existing element of uncertainty. There are many reasons why architects are often forced to present drawings for estimating which are more or less incomplete, the principal one, of course, being the short time allowed for their preparation; but the architect should not be hurried at the expense of the contractor; such loss should be put on the owner who demands it, and the architect should insist on time to complete his work properly. The great trouble comes from owners insisting on knowing the cost prematurely and at another's risk. And although competition is such that contractors seldom refuse to estimate on an incomplete set of drawings, they are, nevertheless, sure to lay an anchor to windward, and provide for contingencies in ways which are sure to prove embarrassing to both owner and architect at later stages of the work.

After figuring the value of the materials, comes, secondly, the question as to the amount of labor involved, and it needs no demonstration to prove that value of this item is much more variable and indefinite than that of materials. The ability to place a proper estimate on labor comes only after experience and careful observation on the part of the contractor, which should be supplemented (although it rarely is) by comparisons derived from a set of books, which should be so kept as to show at a glance the profit or loss of each piece of work as soon as it has been finished and paid for. The item of labor, which is at best indefinite and liable to wide variation, has been made more indeterminate of late by the restrictions and limitations which have been placed upon it by the labor unions, the most conspicuous of which is the maintaining of a uniform rate of wages without regard to a man's individual ability. Another element of uncertainty has also been added from the necessity of carrying on building operations during the winter months, when the amount of work performed is largely dependent upon the conditions of the weather.

Third. The contractor must make due allowance for contingencies, wear and tear of plant, accidents, strikes, and last, but by no means least, for the vagaries and peculiarities of the architect and his superintendent, and the risks he, the contractor, runs under existing conditions of being called upon to perform work under blanket clauses and general conditions for which no definite allowance was made in the estimate, and which are, of course, unknown quantities.

Fourth. The contractor must include the profit he desires to realize over and above the cost of the labor and materials and allowances for contingencies, etc.

It can be seen from this brief analysis of the conditions under which estimates are obtained, that under most favorable circumstances there is a large element of uncertainty. And, therefore, under the normal or usual conditions existing to-day, the uncertainty practically dominates, and the estimate is consequently simply an intelligent guess.

Now it is a self-evident fact that no contractor will undertake work which in the end will not yield a fair profit, and the greater the element of uncertainty which exists, the larger will be the margin of profit, a parallel case being that of insurance where the greater the risk the larger the premium. It is the owner who pays in the end for this uncertainty, and as the reputation of the architect is in a large measure dependent upon his standing with his clients, it is manifestly for his advantage to do all in his power to reform the methods of estimating, so as to reduce to the minimum this element of uncertainty, and thereby be enabled to bring the cost of his buildings to the lowest point consistent with good construction and thorough work.

It must not be taken for granted that because, when estimates are received on a given piece of work, and it appears that the cost is within reasonable limits, that the profit of the contractor has necessarily been included; for it has already been pointed out in a previous paper that it is a well-known fact that many contractors figure work at cost or even below, and depend for their profit on the " extras " which they are morally sure will be required before the work is finished. An example of this can be seen in the case of a contractor who figured for years in the office of a well-known firm of architects without getting a single piece of work, and although his competitors were far below him in price, they claimed to make a good profit on their contracts. At last he determined to find out the secret of their success, and figured the next time to do the work at much less than cost. This time he was successful in obtaining the contract, and as the work progressed he soon found that by means of " extras " he was able not only to make up the deficit, but in the end to realize a satisfactory profit.

This is but a single illustration of one of the most radical defects of our present methods of estimating. For the contractor should be paid for "extras" at the same rate as for similar work included in the contract, but under existing conditions it is practically impossible to regulate this abuse without wranglings, delays, and lawsuits, which cost in the end as much, if not more, than the payment of the contractor's unjust demands.

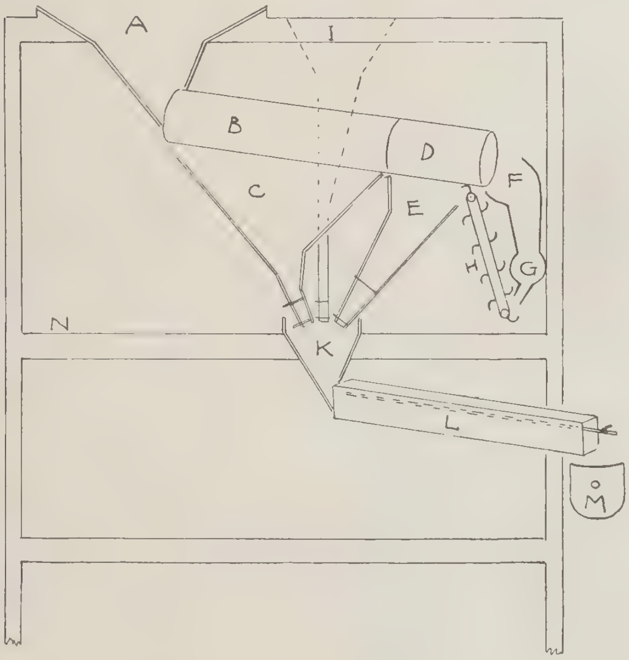
The fault lies in the system which has grown without regulation or restriction from the time, not much more than fifty years ago, when the architect and builder were one and the same person.

(*To be continued.*)

CONCRETE MIXING MACHINE USED IN CONSTRUCTION OF BOSTON SUBWAY.

THE machinery for sifting sand and mechanically mixing and delivering concrete which is used on the third section of the subway was designed by the contractors, Messrs. Everson & Co. It is not especially new in principle, but is combined in a very effective way and operates very successfully. The accompanying sketch diagram will illustrate the idea of the machinery, though it does not in any sense illustrate the actual construction. It will, however, serve to make clear the process by which the various materials are mixed and converted into concrete.

The earth which is excavated from the subway at this section of the work is composed almost entirely of clean, sharp sand, with a great deal of gravel and some loose stones scattered through it. All the material is suitable for use in concrete. The mixer is housed in a strong wooden structure some 30 ft. square, which is strongly braced, and rests upon a track which is extended as necessary, so that the structure closely follows the group of derricks and hoisting machinery used to assist in excavating the soil. The earth as excavated is hoisted by the derricks to the top of the mixing house and dumped into a large hopper at A. Thence it descends into a long cylinder, BD, the first portion of which is covered with a fine wire netting. The cylinder is in constant rotation, and the sand is sifted out, falling into the hopper C, while the stone and gravel are carried along by the rotation of the cylinder to the portion marked D, which is cased with a netting of a coarse mesh, sufficient to allow the gravel to fall through into hopper E, while the stones are carried along and dropped out at the end of the cylinder into the hopper F, which leads directly to a stone crusher, G. This reduces the stones to a uniform size, discharging the fragments into a series of scoops on an endless belt, H, which raises them into the hopper E, where they join the gravel delivered from the cylinder D. The cement is hoisted by derricks to the top of the house and dumped into a hopper at I. The hoppers C, I, and E are brought together at one point, K, the ends of the hoppers being fitted each with two valves so placed that definite proportions of the sand, gravel, and cement can be measured as they are passing. The mixture drops into the hopper K, and from there into a sheet-iron rectangular cylinder or prism, L, in constant rotation, through the length of which is a large water-pipe pierced with holes at frequent intervals, which supplies the necessary water for the concrete. The finished mixture is finally dropped out at the end of the cylinder L into buckets, M, which, as fast as filled, are conveyed away by derricks to the spot where they are wanted on the works. In operation, one workman is stationed on top of the house to take care of the vats A and I; three workmen are placed on platform N to take care of the valves at K; a fifth man is required at the stone crusher; and a man is needed at the end of cylinder L to regulate the amount of water delivered to the concrete; in addition to which an engineer is required to operate the steam engine which is placed on platform N, and supplies the motive power operating the two cylinders, the stone crusher, and the belt lift; seven men in all being required.



This mixer has a capacity of from 250 to 300 bbls. of cement per day, equivalent to about 1,000 to 1,200 bbls. of finished concrete, the concrete used on the subway works being mixed in the ratio of one part Portland cement, two and a half parts sand, and four parts of broken stone or gravel.

ENAMELED BRICK FOR THE SUBWAY.

WHILE the Boston Rapid Transit Commissioners have been making experiments with Keene's cement plastering and Portland cement, to determine whether one of these materials may not be as satisfactory as enameled brick for lining the walls of the Boston Subway, the question has been decided in very short order under similar conditions elsewhere. What is to be known as the Blackwell Tunnel is being constructed in London under the bed of the Thames, connecting the densely populated districts of the city below the Tower. There seems to have been no doubt about what material to use for facing the interior of the tunnel. It will be lined throughout, approaches and all, with white enameled bricks and tiles, and it is proposed to wash it down thoroughly with a hose every morning. There is no reasonable doubt that this is the cleanest, most cheerful, and most enduring finish which can be devised for such constructions, and there is no reason why our Transit Commissioners should longer hesitate in their choice.

CEMENT AFFECTED BY FREEZING.

IT appears to be ascertained as a fact, based on more than six thousand recorded results, that Portland cement mortar suffers no surface disintegration under any condition of freezing, but that in most cases its strength is reduced, in some cases by as much as 40 per cent. Rosendale cement is disintegrated when exposed to frost while setting, and its cohesion may be entirely destroyed by immersion in water, which becomes frozen around it. Salt water prevents this disintegration to a large extent, but seems to have an injurious effect upon the strength, and the cement below the disintegrated surface is stated to be increased in strength when the Rosendale cement is used. A mixture of a natural-rock cement and of Portland cement is found to give very satisfactory results, as its surface does not disintegrate, and its strength is increased by the freezing. Portland cement is injured less proportionately as the percentage of the cement in the samples is reduced. Again, though lime mortar is ruined by alternate thawing and freezing, fairly good results may be looked for in the case of brick masonry when the mortar is kept frozen for some time after laying. — *The Railway Review.*

Recent Brick and Terra-Cotta Work in American Cities.

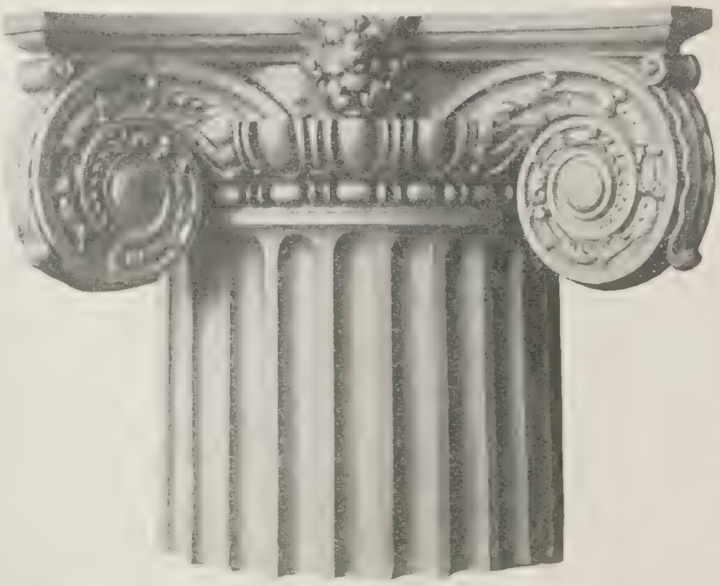
A Department Devoted to the Interests of the Manufacturer.

CHICAGO.— Chicago's new census leaves the population still below the 2,000,000 mark. But though not as yet the metropolis of the country, this city boasts achievements in many lines aside from pork packing. Her public library has issued more books, by far, this year than any other library in the country. And when the new library building is ready, another stride will be taken. Her Art Institute, though not richly endowed, has accomplished much. Visitors to the galleries of the Institute have aggregated more than those of any other museum, attendance on single days sometimes exceeding 10,000 persons. Students in the Art School of the Institute have numbered this year 1,200. Figures are dry, but some in connection with this marvelous art school are interesting. Of the 650 day students this year, 190 were men. Of the 511 night students, 98 were women. Of the 39 architectural students, 1 was a woman. In the designing (interior decoration) class there were 8 men and 67 women.

EXECUTED IN TERRA-COTTA BY THE NORTHWESTERN TERRA-COTTA COMPANY.

The Art School is taking on a more advanced character than formerly, many of the students having taken a long preliminary course of study for their life's work as artists. The school is not for amateurs to do a little dabbling. One evidence of this is the fact that next year the Director of the Institute will announce a prize of $200 for the student who excels in composition. Each competitor for the honor will have to show a series of several paintings.

The Architectural Department of the school is making a very creditable display of students' work. With all the advantages, both of the Art Institute and the Armour Institute, there will soon be an architectural school, far beyond 39 in number of students, and worthy to meet the urgent demand for architectural training. There is an immense constituency beyond the influence of Columbia, Cornell, and Boston Technology.


TERRA-COTTA CAPITAL, BURNHAM ATHENÆUM, CHAMPAIGN, ILL.
J. A. Schweinfurth, Architect. Made by Perth Amboy Terra-Cotta Company.

Building reports continue to be slow. There is some activity now in the down-town district. In addition to the numerous alterations of old buildings, and the tearing down of the old government building, and the destruction of half the Grand Pacific Hotel to make way for the new Illinois Trust Bank Building.

MEDALLION FOR RESIDENCE, PHILADELPHIA.
Baker & Dallet, Architects. Made by Conkling Armstrong Terra-Cotta Company.

The Merrimac, a large office building, by D. H. Burnham & Co., is about ready for basement columns. The exterior of this building, it is said, will be glazed terra-cotta.

The steel frame for the new Ashland Block, J. A. Rogers, architect, is rising.

The Silversmiths' Building, which is to be occupied by jewelers and silversmiths exclusively, is under construction.

The Trude Building has reached its roof.

Referring again to the Grand Pacific Hotel, the other half of the building, which belongs to L. Z. Leiter, will be remodeled by Jenney & Mundie, and will be leased for a hotel. Though made of only half a hotel, with some two hundred rooms, it will be a very respectable whole one.

Among building announcements may be noted a $40,000 residence by Shepley, Rutan & Coolidge; one of nearly the same cost, by Chas. S. Frost; bids are being taken on a church by Patton & Fisher; permit has been taken out for the Alexian Brothers' Hospital (four stories, and 175 by 260 ft. in plan) which was planned by Richard E. Schmidt.

ST. LOUIS.—Notwithstanding the efforts of the newspapers to convince us there is more building being done here than during any previous season, and there promise of greater things for the future, the fact remains that there are few architects or builders but who are complaining of dull times, and who speak very discouragingly of the prospects for the future.

A few weeks ago there was a feeling that the worst had passed, and that with the coming of fall business would have assumed its normal condition. But even this faint gleam of hope has been dissipated by the general feeling of uncertainty. Several large factory and other important buildings which were contemplated have been laid over until the results of the coming election are known, while others have been abandoned altogether, even after work had commenced.

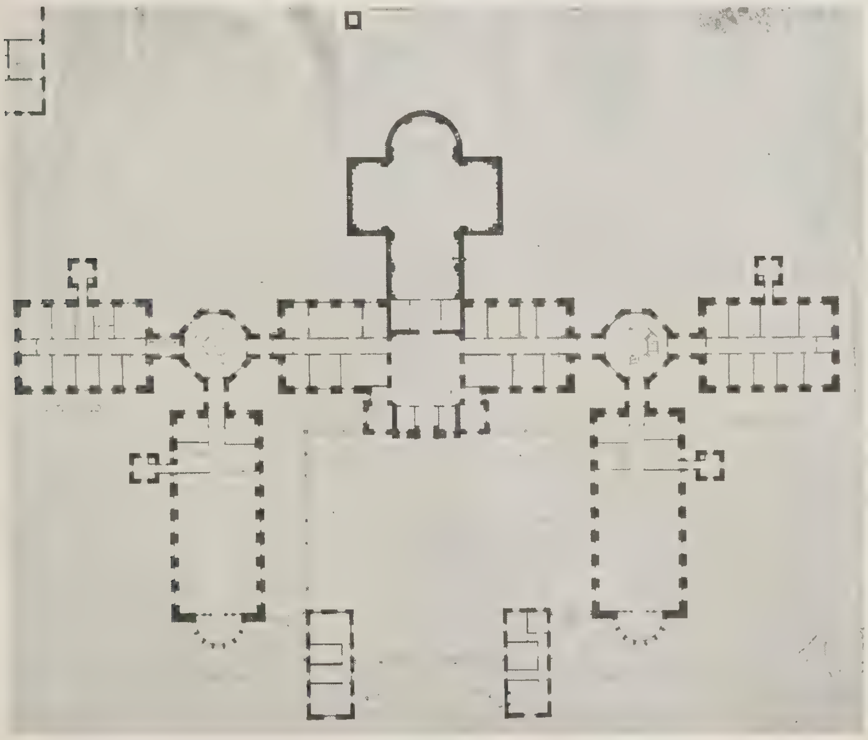
There is much of the city which was destroyed by the late storm that has not been rebuilt yet, and much which will not be for a long time to come.

The residence portion of the city visited by the late storm was mostly occupied by those in moderate circumstances, who, after years of toil, had saved enough to build or buy themselves a home, which in many instances were not fully paid for. Very few of them carried tornado insurance, and, consequently, to provide the means to rebuild will take time.

The Ives Bill, limiting the height of buildings to 125 ft., which was defeated in the City Council a short time ago, has been again introduced into the House of Delegates in practically the same form as before, excepting that the height is limited to 150 ft. Its passage is being vigorously opposed by the real estate men, but there does not seem to be the same amount of opposition to this bill as to the former.

ST. MARGARET MEMORIAL HOSPITAL, PITTSBURG, PENN.
Ernest Flagg, Architect.

Permits have been taken out for buildings which, if built, would far exceed this limit, but it is not thought that many of them will, at least not at an early day; but the permits, if they will hold good, might prove good investments as speculative mediums should the ordinance pass.



ST. MARGARET MEMORIAL HOSPITAL, PITTSBURG, PENN.
First floor plan. Ernest Flagg, Architect.

Among those who have taken time by the forelock are the Holland Building Company, who are at present building the Holland Building on 7th Street, which was mentioned in a former letter. They have taken out a permit for a fourteen-story building on the corner of 7th and Olive Streets, which would form a part of the building now being erected.

Improvements in the vicinity of Cupples Station continue, architect J. L. Wees having just completed plans for a large building on 7th Street and Clark Avenue.

Mr. Wees is also preparing plans for the Scottish Rite Cathedral, to be built on the property recently acquired on Locust Street by that organization.

The old landmark at the corner of Broadway and Pine Street, for so many years occupied by Finney & Hull, is being rebuilt by Architect Isaac Taylor. The same architect is also putting up a five-story wholesale and warehouse at the corner of Broadway and Clark Avenue, for Mr. Andrew Gay.

On 4th and Vine Streets, Shepley, Rutan & Coolidge are erecting a seven-story building for Mr. Henry Hitchcock, at a cost of $125,000. The building is being constructed of gray brick and terra-cotta, and of the slow combustion type in construction. The building is exceptionally well adapted to commercial purposes, being one of the few locations where a building of medium size is favored with street exposure on three sides.

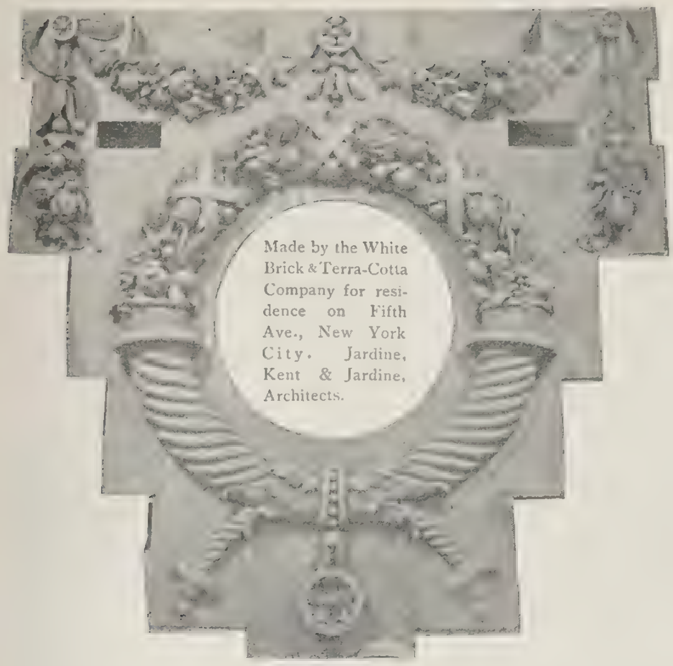
The building which the same firm is putting up on Washington Avenue, at a cost of over $200,000, for the Lindell Real Estate Company, has reached the fourth floor. It is also of gray brick and terra-cotta and slow combustion.

Architect F. C. Bonsack has prepared plans for extensive improvements to the Masonic Home on Delmar Avenue. He also has under construction at Granite City, Ill., an eight-room brick schoolhouse, and fifty houses for the St. Louis Stamping Company, and has just completed a lot of twenty-five houses there for the same company.

PITTSBURG. — New building operations are at a standstill mainly among the larger and better class of buildings.

The Carnegie Steel Company has decided to build a $1,000,000 addition to its already extensive plant.

An elaborate plan is being pushed to erect a $50,000 market house in the East End district.



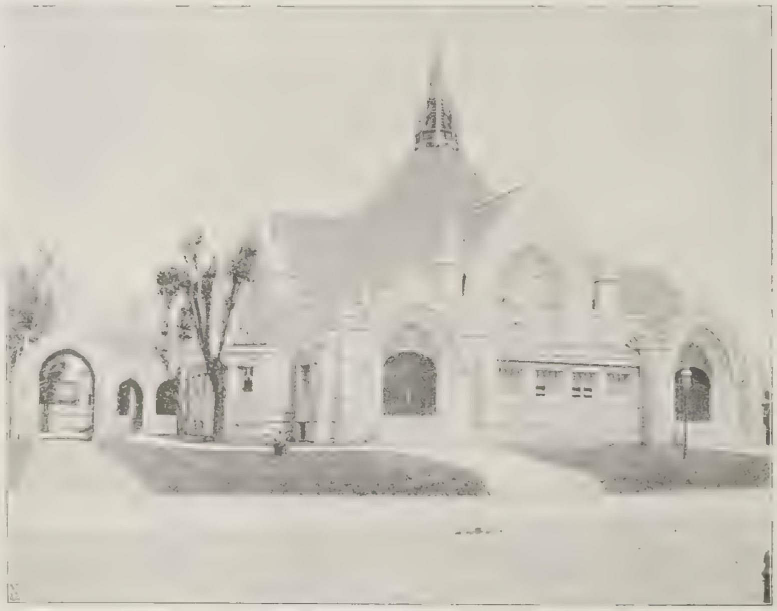
Made by the White Brick & Terra-Cotta Company for residence on Fifth Ave., New York City. Jardine, Kent & Jardine, Architects.

The congregation of the Third Presbyterian Church has appointed a committee to take steps towards the erection of a new church; competitive drawings will be asked.

Architect T. H. Scott has prepared plans for a three-story brick colonial building on Penn Avenue, to be used as a museum and hall for "Daughters of the American Revolution."

Two apartment buildings will be erected in Allegheny this season, one after plans of Architect F. C. Sauer, and the other of Architect J. A. Jacobs.

Architect W. S. Fraser has prepared plans for a $12,000 colonial residence for Mr. Dawes, at New Brighton.



THIRD PRESBYTERIAN CHURCH, CHESTER, PA.

Architect Joseph Stillberg has prepared plans for an engine house for the Thirteenth Ward, Allegheny.

Architect W. A. Thomas is the successful competitor for the municipal hall and engine house at Rankin.

Architect J. N. Campbell has prepared plans for a brick schoolhouse at Canonsburg.

Architects Bartberger & East are preparing plans for a bank building for the State Bank of Pittsburg, to be erected on Liberty Avenue. They are also preparing plans for a brick schoolhouse at Monongahela City.

Architect F. C. Sauer is preparing plans for a schoolhouse and convent for the Sisters of Saint Stanislaus.

MINNEAPOLIS.— Politics seem to have had a most depressing effect on our midsummer business, and until matters are more definitely settled, a number of important building projects will be side-tracked; among them a number of large grain elevators. These, no doubt, will be built before the season ends, however.

Westminster Church, C. E. Sedgwick, architect, will be pushed to completion, the plans being about finished. It is to be built of dark St. Louis pressed brick with brownstone trimmings. Cost, $85,000.

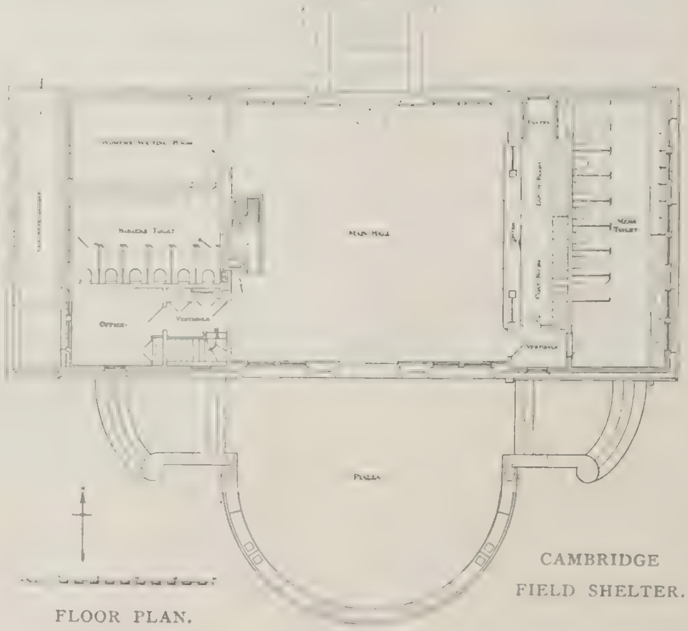
Orff & Joralemon are architects for the new school building at Decorah, Iowa. Cost, $25,000.

The Northwestern Mantel Company, of Minneapolis, has secured two large contracts for tile and mantel work; one in Park Office Building, at Pittsburgh, Penn.; the other in Great Northern Hotel at Chicago, Ill. Each contract amounts to several thousand dollars.

Architects Wm. M. Kenyon, W. H. Dennis, and S. J. Bowler, of Minneapolis, and Cass Gilbert and Herman Kretz & Co., of St. Paul, have submitted designs in the Montana Capitol Competition.

WE publish herewith a view of the Third Presbyterian Church, Chester, Penn., Isaac Pursell, architect. The design is an agreeable treatment of a modern problem in church building. The mass is quaint and pleasing. The details of the stone work are carried out in the perpendicular period of Gothic. The general effect is greatly enhanced by the use of Conosera tiles, which were furnished by the Celadon Terra-Cotta Company, Charles T. Harris, Lessee. There is a quality of color and permanency obtained by the use of these tiles which can be acquired in no other way.

THE plan shown herewith is of the new Park Shelter for Cambridge Field, Cambridge, Mass.; Andrews, Jacques & Rantoul, architects. It will be seen, by referring to plates 38 and 41, that excellent results have been obtained in the texture of the wall by introducing courses of all red brick with the courses having black headers. The batter is laid up in one pattern, the main wall above the batter to the tops of the first-story windows in a second, and the frieze in a third. The bricks are laid with a wide joint troweled off flush with the wall, the mortar being white. By varying the number of red courses, a large variety of patterns may be obtained situable for large wall surfaces without changing the style of the bond.



FLOOR PLAN.

CAMBRIDGE FIELD SHELTER.

ITEMS OF PRACTICAL VALUE.

The New York Architectural Terra-Cotta Company received the following letter from Messrs. Pierce & Bickford, architects of the new City Hall at Elmira, N. Y., for which this company made the terra-cotta: —

> "Your favor enclosing photograph of the sculptured panels in each of the pediments of City Hall, and photograph of the column, received. The work is the finest of the kind we have ever seen; in fact, the terra-cotta for the City Hall throughout has excited universal admiration, and it will be a piece of work that you have good reason to feel proud of when the building is completed."

By the same mail came another spontaneous and highly eulogistic reference to this company's work from Mr. A. H. Kipp, Wilkesbarre, Penn.: —

> "Permit me to express my gratification and pleasure in the work you have done for the public school being erected in this city under my direction. The terra-cotta is as near perfection as mortals can make it. The string-courses are even, and the pieces fit perfectly. If there be any criticism that is adverse, it might possibly be said that the foliage in tower frieze has a little too much relief, considering the height from street, which is but 70 ft. However, this is a small fault — there are spots on the sun."

While this speaks well for the progress already made in a comparatively new industry, it is but a foretaste of what is yet to come artistically, as well as in reliability and mechanical fitness. In regard to the relief of ornament, we would say that boldness is a good fault in a frieze.

The White Brick and Terra-Cotta Company, New York, has just completed the terra-cotta for the large Sampson Building, Wall Street, for the Duchess De Dino, Clinton & Russell, architects; and have during the last month closed the following contracts: Residence for P. Tiffany, Esq., Westbury, Long Island, W. J. Wallace, architect; factory building, Altoona, Penn., W. L. Plack, architect; Holloway Building, Norwich, Conn.; six residences, E. 82d Street, New York, Mortimer P. Thain, architect; Irving Savings Bank Building, Chambers Street, New York, Thomas R. Jackson, architect; Store Building, Broome Street, New York, L. Korn, architect. The prevailing color in all this work is white or Indiana lime-stone shade.

The Donnelly Brick and Terra-Cotta Company, of Berlin, Conn., will supply the terra-cotta for the Methodist Episcopal Church at Newton, Mass., Cram, Wentworth & Goodhue, architects; Mitchell & Sutherland, builders. Engine House, Fall River, Mass., J. M. Darling, architect; J. O. Wagner & Co., contractors. Working Woman's House, Lowell, Mass., Keely & Houghton, architects; Conners Brothers, contractors. Bartlett Street School, Lowell, Mass., Stickney & Austin, architects; P. O'Hearn, contractor. High School, Lawrence, Mass., P. Regan, architect; Driscoll & O'Brien, contractors.

Waldo Brothers, Boston, are furnishing the Brooks, Shoobridge & Co.'s brand of Portland cement in the new reservoir for the city of Cambridge; also for work being done at Malden, Mass.; and the new warehouse on Huntington Avenue, Boston, of which Andrews, Jaques & Rantoul are the architects.

The same company is also supplying the Hoffman cement and West Kent Portland cement to all sections but one on the Metropolitan Sewer running from Dedham to Neponset, Mass.

The New Jersey Terra-Cotta Company will supply the architectural terra-cotta for the Y. M. C. A. Building, Cambridge, Mass.; Masonic Building, Newton, Mass., Hartwell, Richardson, & Driver, architects; the Princeton, N. J., Bank, W. E. Stone, architect; apartment house, Madison Avenue, New York City, Henry Andersen, architect; the German Herald Building, New York City, Louis Korn, architect; Phœnix Bank Building, Brooklyn, N. Y., Wm. H. Beers, architect.

G. R. Twitchell & Co., Boston, are supplying their red brick for the new storage warehouse, Huntington Avenue, Boston, Andrew, Jaques & Rantoul, architects; Chase Building, Boston, Loring & Phipps, architects; new factory for the American Wringer Company, Woonsocket, R. I., Martin & Hall, of Providence, architects; Working Woman's Home, Lowell, Mass., Keely & Houghton, of Brooklyn, architects; Bartlett Street School, Lowell, Mass., Stickney & Austin, architects.

G. R. Twitchell & Co., Boston, have supplied two hundred and fifty thousand gray mottled bricks for the Gate of Heaven Church, South Boston, Geo. B. Clough, architect; also the gray bricks for the SS. Peter and Paul Roman Catholic Church, Fall River, Mass., Cram, Wentworth & Goodhue, architects; and their buff brick for a business block at Somersworth, N. H., Geo. Brown, Dover, N. H., architect.

The roofing tile made by the Celadon Terra-Cotta Company, Charles T. Harris, Lessee, has been specified on the following work: Boat house and shelter for Lincoln Park, Chicago, J. C. Llewellyn, architect. Grant Memorial Building, Columbus, Ohio, Elah, Terrell, & Co., architects. Lackawanna Country Court House, Scranton, Penn., T. I. Lacey & Son, architects. Passenger station for the Erie Railway Company, Middletown, N. Y., G. E. Archer, architect.

The white brick made by the White Brick and Terra-Cotta Company, New York, has been specified on a large job at Somerville, Mass. These bricks are made from clean white clay, and are neither sprayed nor dipped. The success that this company has had with white brick and terra-cotta has induced them to go into the manufacture of all other colors of brick.

The enameled bricks manufactured by the Somerset & Johnsonburg Manufacturing Company, Somerset, Mass., are being used in the Warren Chambers Building, Boston, Ball & Dabney, architects; and for the subway work being done by the N. Y., N. H. & H. R. R. at the following places in Massachusetts: Campello, Heath, Boylston, Jamaica Plain, and Forest Hills.

The Powhatan Clay Manufacturing Company, of Richmond, Va., are supplying their cream-white bricks for two flat houses East 72d Street, New York City, Neville & Bagge, architects; four flats on 176th Street, New York City, David W. King, architect; also for thirty residences at Washington, D. C.

The Builders' & Traders' Exchange, 63d and Halsted Streets, Chicago, have a department given up to the exhibition of modern building materials. They would be glad to have sent them for this purpose manufacturers' samples, price-lists, and catalogues. Address, T. P. Hughes, Secretary.

William Connors, Troy, N. Y., manufacturer of American Seal Mortar Colors, has established the following branch houses: James C. Fagan, 9 Peck Slip, New York City; Stockroff & Co., 407 North 12th Street, St. Louis, Mo.; J. L. Perkins & Co., 243 Lake Street, Chicago, Ill.

The Pioneer Fire-proof Construction Company, of Chicago will supply their material for the road-ways and foot-passages of six viaducts to be built on the Lake Front Park for the Illinois Central Railroad; J. J. Wallace, chief engineer.

Waldo Brothers, Boston, furnished Alsen's Portland Cement for all the work done in Section 1 of the Boston Subway, and also for part of the work on three other sections that have been let.

The Clearfield Clay Working Company, Clearfield, Penn., are furnishing the brick for public school buildings in their city, also for a church at Philipsburg, Penn.

The new Coe Building, on Broadway, New York City, of which Geo. B. Post is the architect, will be fire-proofed by the Pioneer Fire-proof Construction Company, of Chicago.

The Union Akron Cement Company, of Buffalo, N. Y., are furnishing the cement for concrete foundation for street paving at Erie, Penn.

THE CHEMISTRY OF POTTERY.

BY KARL LANGENBECK,

Superintendent of the Mosaic Tile Company, Zanesville, Ohio, formerly Superintendent of Rockwood Pottery, Chemist of the American Encaustic Tiling Company, etc., Easton, Penn.; Chemical Publishing Company, 1895. *Price,* $2.00.

ANY one who has read the account of the years of patient experimenting and discouraging failures which preceded the successes of Bernard Palissy, the famous French faience artist, can fully appreciate why the secrets of the manufacture of every-day pots and dishes and terra-cottas, which are now so commonplace, were once so jealously guarded. It has, however, been reserved for later investigators than Palissy or the Meissen potters to analyze and classify the physical and chemical properties of burnt clay. Under the title of "The Chemistry of Pottery," Mr. Langenbeck has collected and arranged in a convenient little volume a synopsis of the facts regarding the composition and the properties of porcelain, faience, and the terra-cottas, including complete chemical analyses of the various clays, coloring matters, glazes, and enamels. Such a work is necessarily technical to a very high degree, but the technicalities are such as every intelligent potter will be glad to possess in so tangible and available form. We are so truly creatures of habit that we are often too slow in using our technical aids. Conditions imposed by chance are in the majority of cases accepted as inevitable to the manufacture, and no systematic effort is made to readjust and correct them; and while it is true that mere analyses of materials are of little or no avail in the solving of such problems, the training of the technical chemist fits him better to carry out systematically the many empiric trials necessary for the readjustment of the conditions or their proper establishment originally. This is the *raison d'être* of Mr. Langenbeck's book.

Of the portions directly relating to architecture, there are valuable chapters on majolica and enameled tile, on white enameled brick, and on floor tile and terra-cotta. The book is comprehensively arranged, concisely written, is free from abstract theories, and is thoroughly cross-indexed. It is a valuable addition to the limited literature upon the subject.

BRICK WALLS.

THE logic of common sense is the best form of reasoning, and the soundness of any theory must be confirmed by practise, or our judgment may be led astray.

Take the front and sides of a brick building, for instance, and we shall find that about one fifth part of the entire surface of the walls is composed of mortar, and should a wall become disintegrated by collapse, we shall find that the mortar (in the majority of cases), instead of cleaving to the brick as a cement should do, falls off like a powder, leaving the brick bare as when it left the brick-yard.

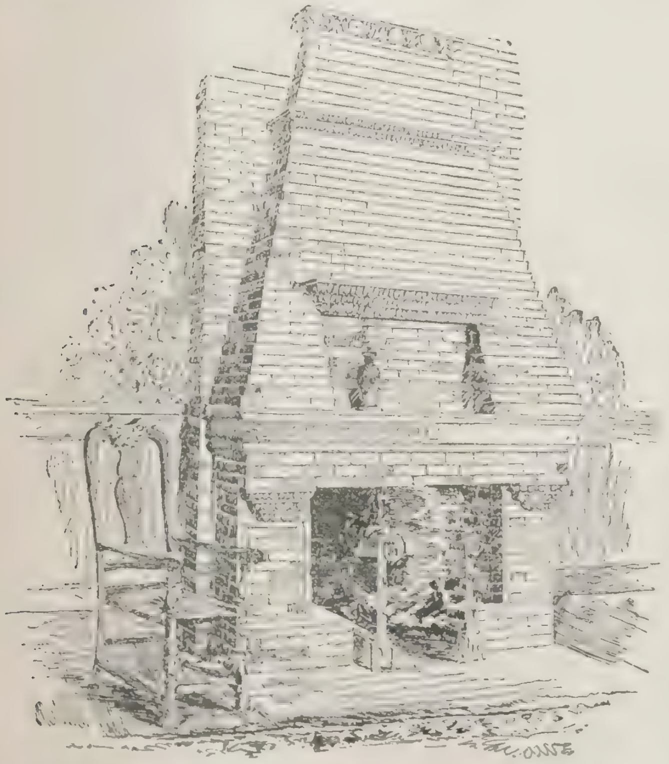
Common sense will then tell us that the mortar used in laying brick is a more important factor in the construction of a durable wall than the brick itself, and as such should be composed of the very best ingredients to effect that result.

Every builder knows that lime and sand are the principal constituents of mortar, and the finer the sand the better the cohesion, as it is rendered less porous, a very important element.

The "American Seal" brick and mortar colors are the product of a practical cement and paint maker, Mr. William Connors, of Troy, N. Y., who has given much study to the subject. When combined in the mortar they act as a mordant or binder on account of their almost impalpable fineness, being ground by machinery, and the coloring matter which they contain will not run, fade, or streak the building, and the various beautiful tints with which they are colored add artistic beauty to the appearance of a wall. They combine beauty with utility, and give to a brick front a very handsome appearance. They are made in five tints, — Milwaukee, terra-cotta, black, red, and brown.

The celebrated Assyriologist Layard, in describing the existing ruins of the tower of Babel (erected about 2247 B. C.) states: "The fire-burnt bricks of which it is built have inscriptions on them, and so excellent is the cement, which appears to be lime-mortar, that it is nearly impossible to extract one whole."

Many houses are rendered damp and unhealthy through what is called "sweating of the walls," but which is really due to porosity of the mortar, which is used in laying the brick. It is often claimed that frame houses are drier and healthier than those composed of brick and mortar, and why is it so? We answer — poor mortar.



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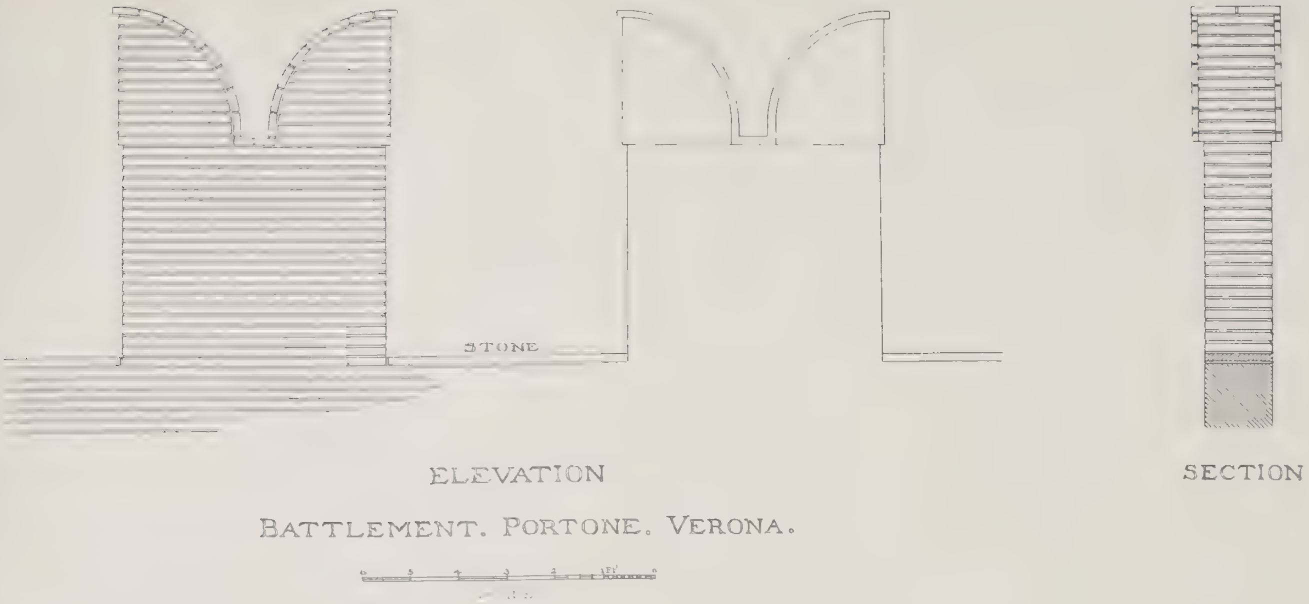
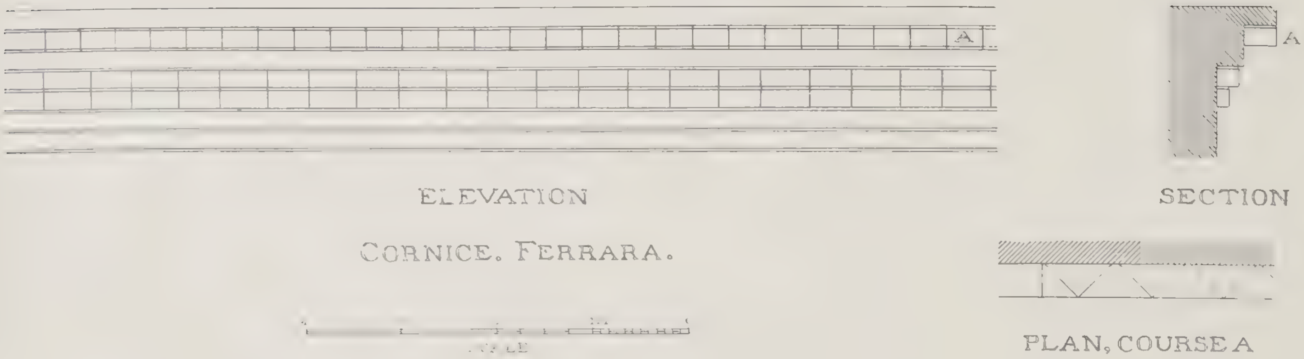
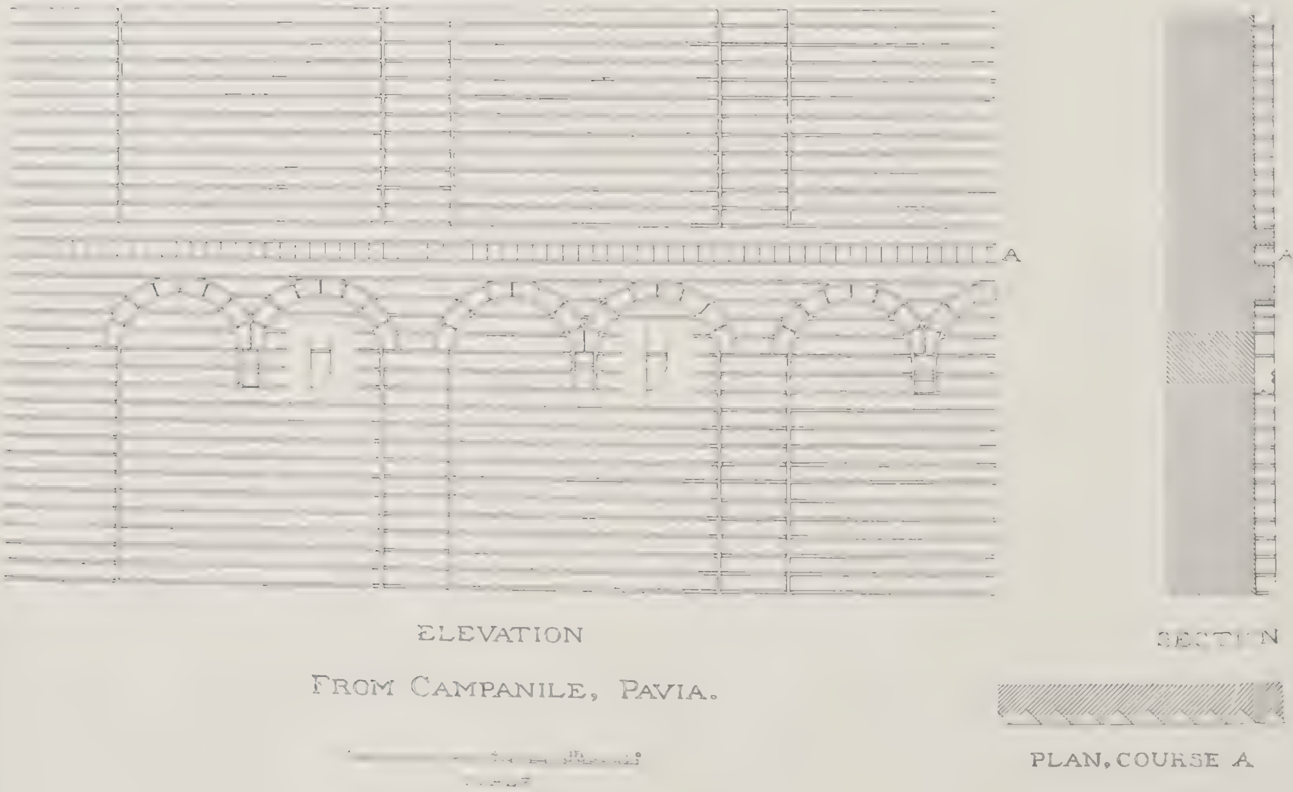


BATTLEMENT. PORTONE. VERONA.



CORNICE. FERRARA.



FROM CAMPANILE, PAVIA.

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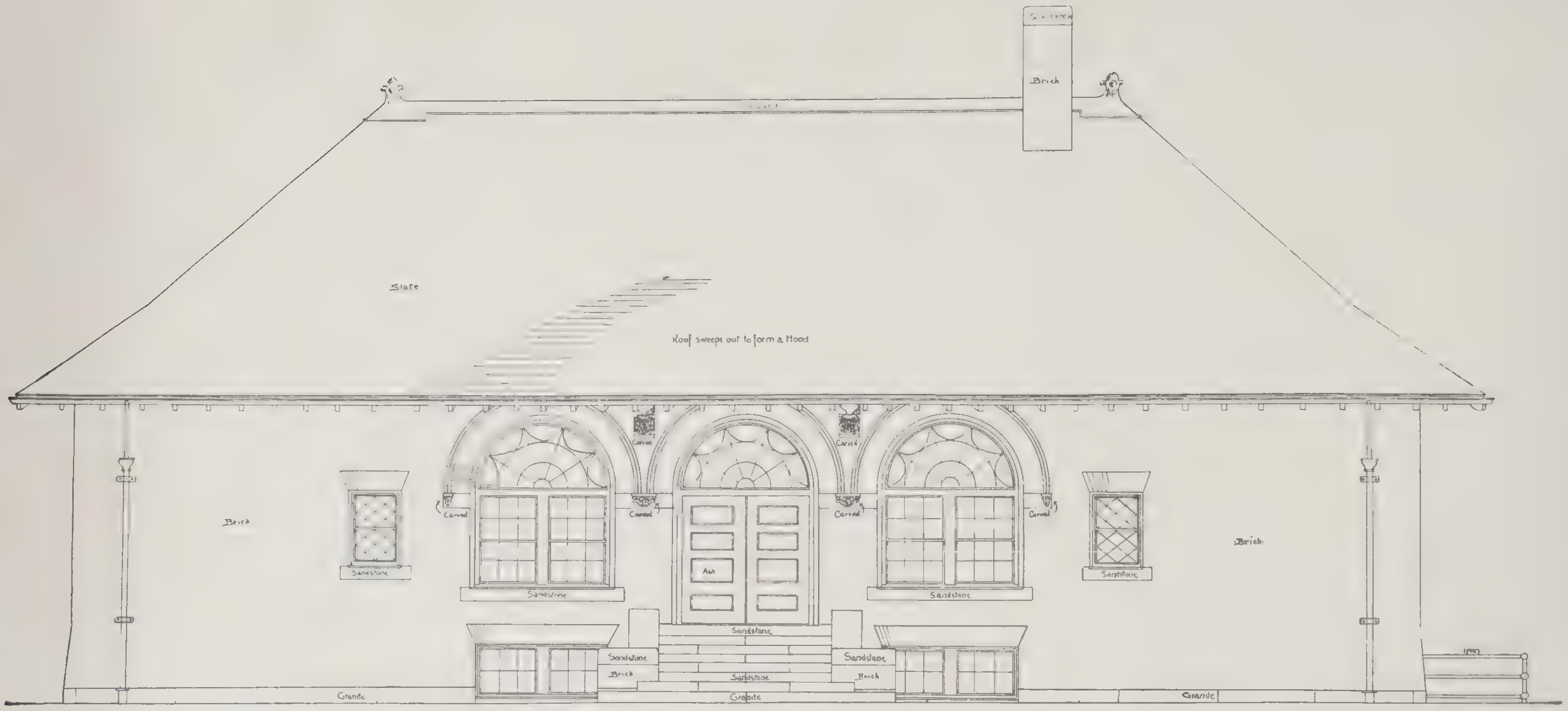
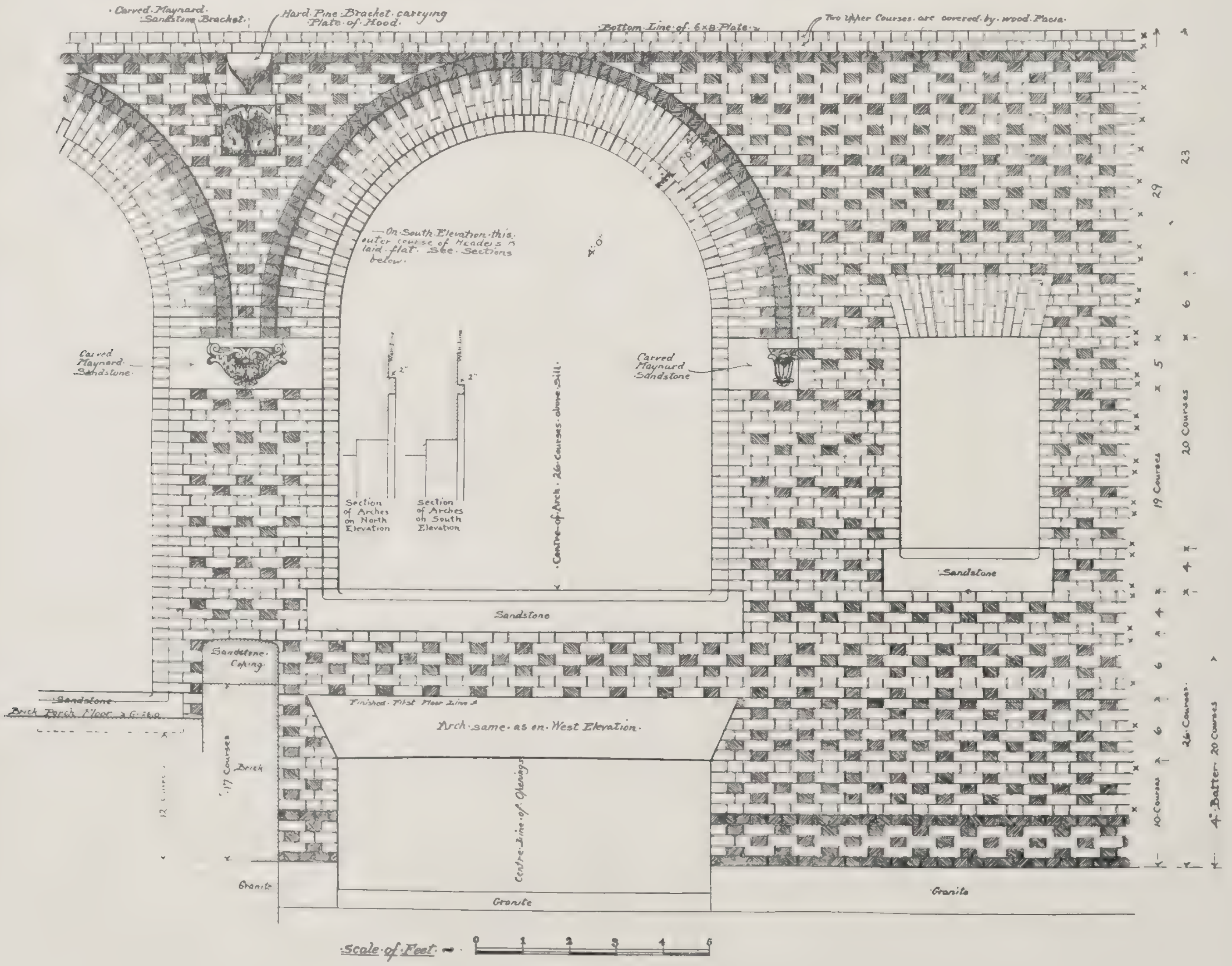


North Elevation

Scale 1/4 Inch = 1 Foot

Scale of Feet ~ 0 5 10 15 20


Carved Maynard Sandstone Bracket
Hard Pine Bracket carrying Plate of Hood
Bottom Line of 6×8 Plate
Two upper Courses are covered by wood Facia
On South Elevation this outer course of Headers is laid flat. See Sections below.
4'0"
Carved Maynard Sandstone
Carved Maynard Sandstone
Wall Line
Wall Line
2"
2"
Section of Arches on North Elevation
Section of Arches on South Elevation
Centre of Arch . 26 Courses above Sill
Sandstone
Sandstone
Sandstone Coping
Sandstone
Brick Porch Floor
Finished First Floor Line
Arch same as on West Elevation
17 Courses
Brick
12
Centre Line of Openings
Granite
Granite
Granite
29
23
6
5
6
20 Courses
19 Courses
4
4
6
6
26 Courses
10 Courses
4" Batter 20 Courses
Scale of Feet ~ 0 1 2 3 4 5

FIELD SHELTER, CAMBRIDGE, MASS.

ANDREWS, JAQUES & RANTOUL, Architects.

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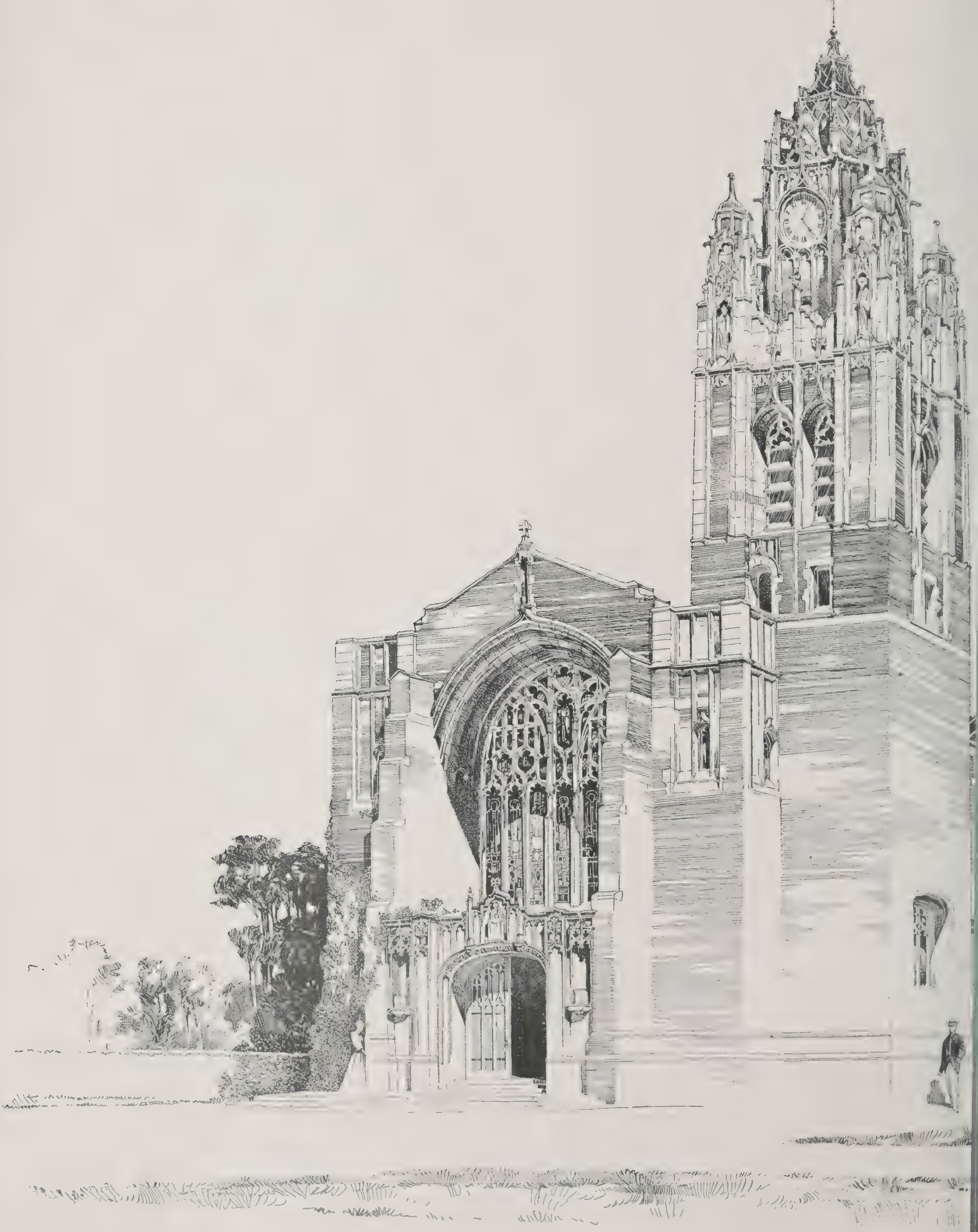
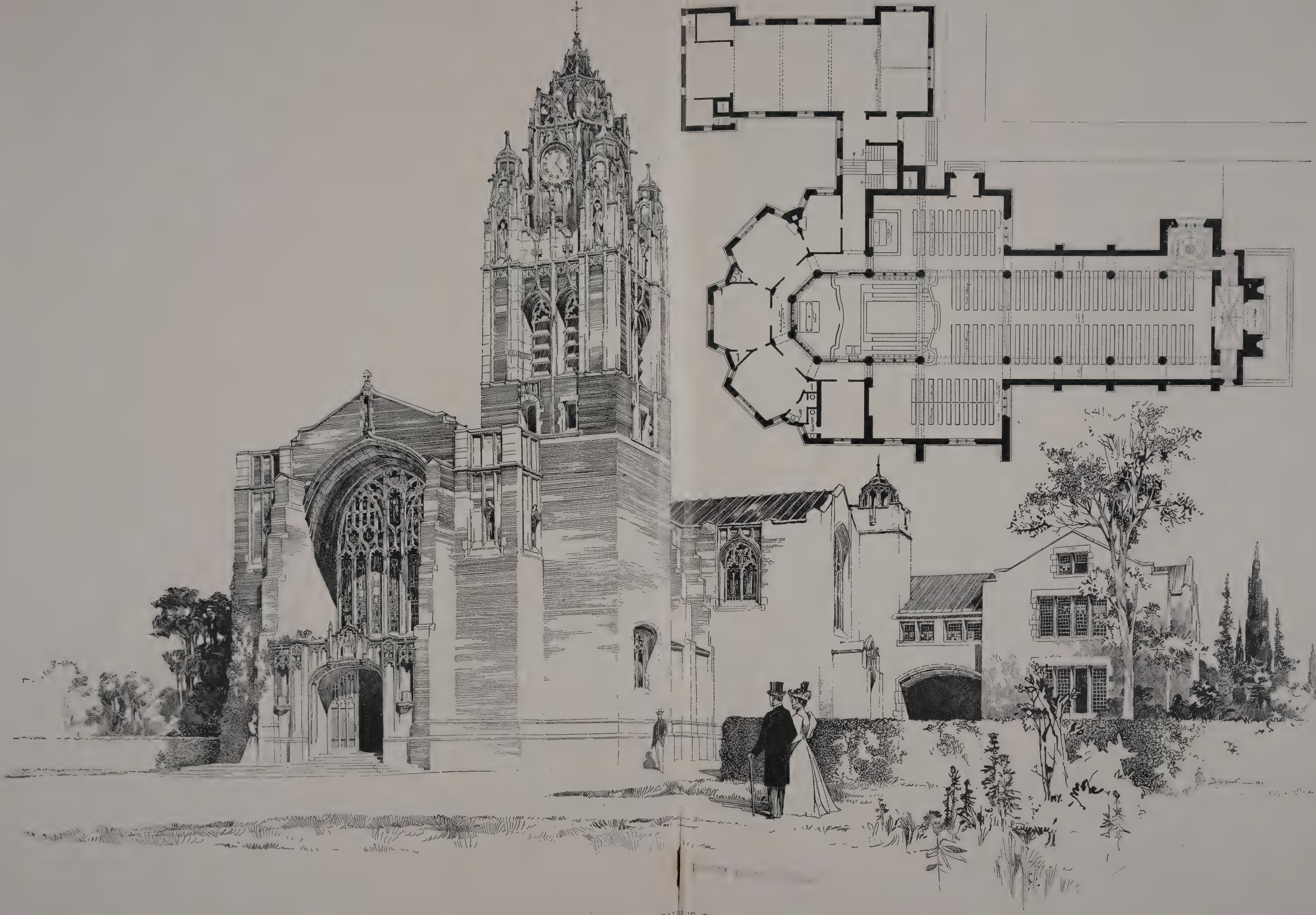
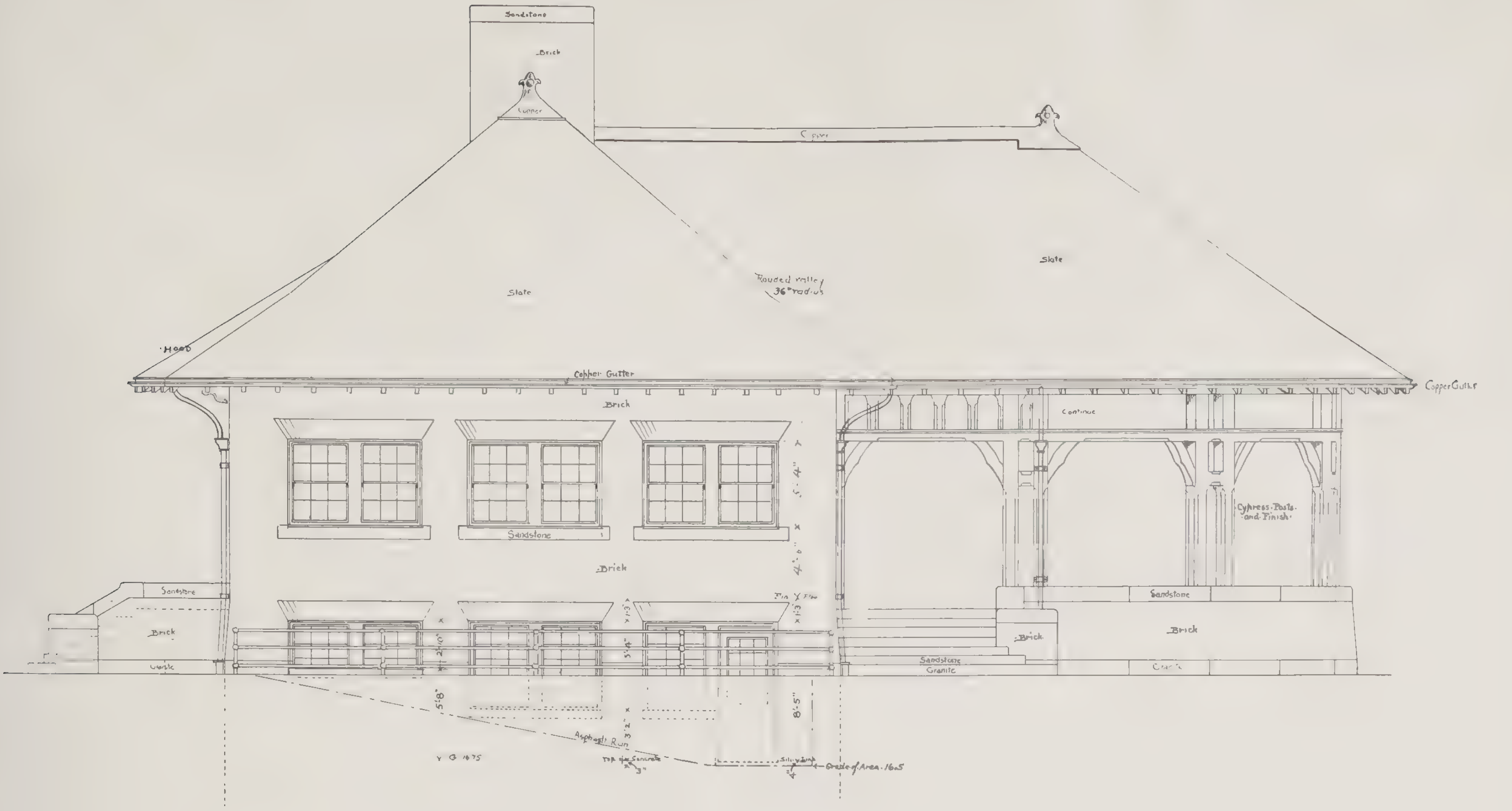
VOL. 5. NO 7.



COMPETITIVE DESIGN, ST. P
CRAM. WENTWORT

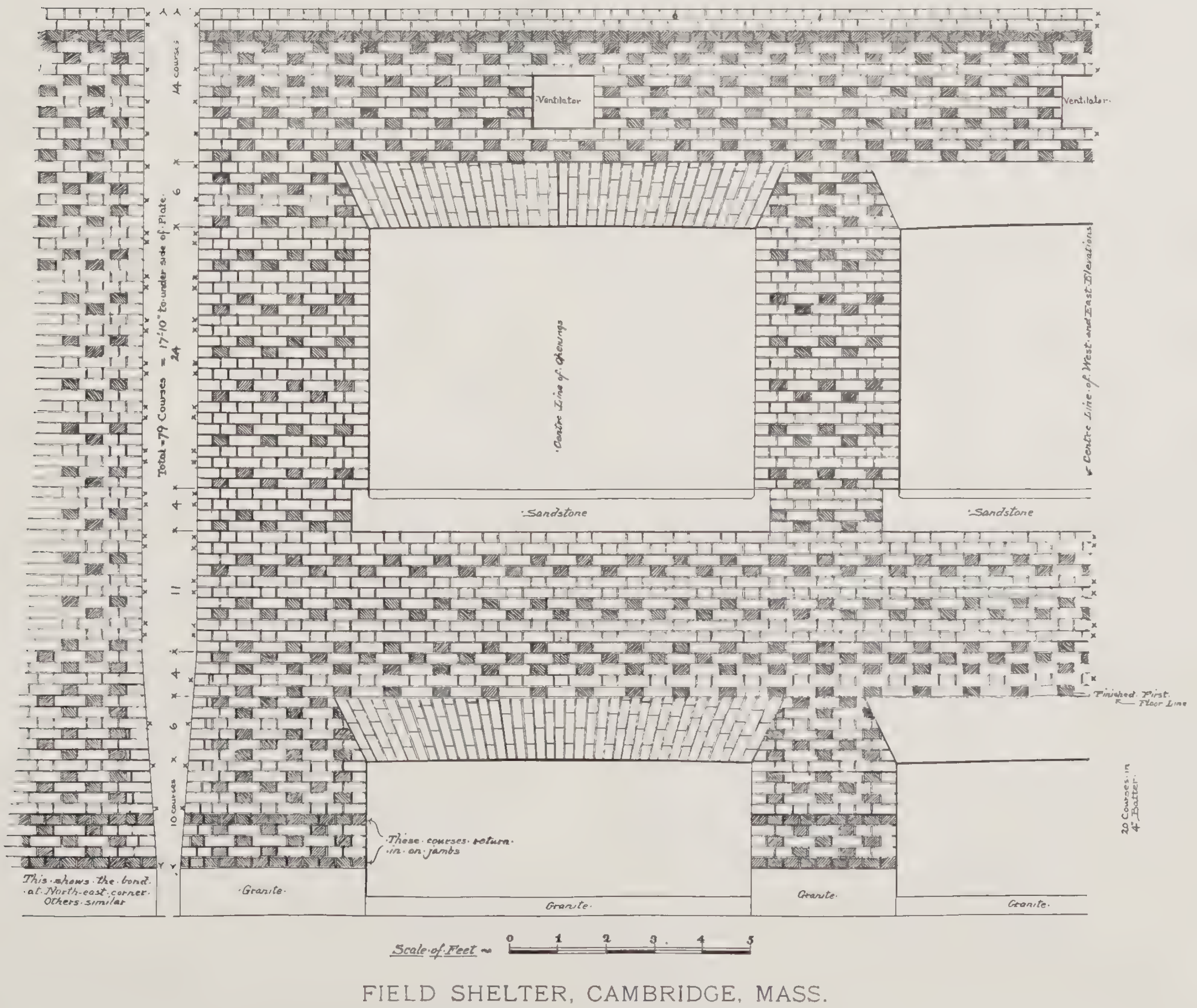


COMPETITIVE DESIGN, ST. PAUL'S CHURCH, ROCHESTER, N. Y.
CRAM, WENTWORTH & GOODHUE, Architects.



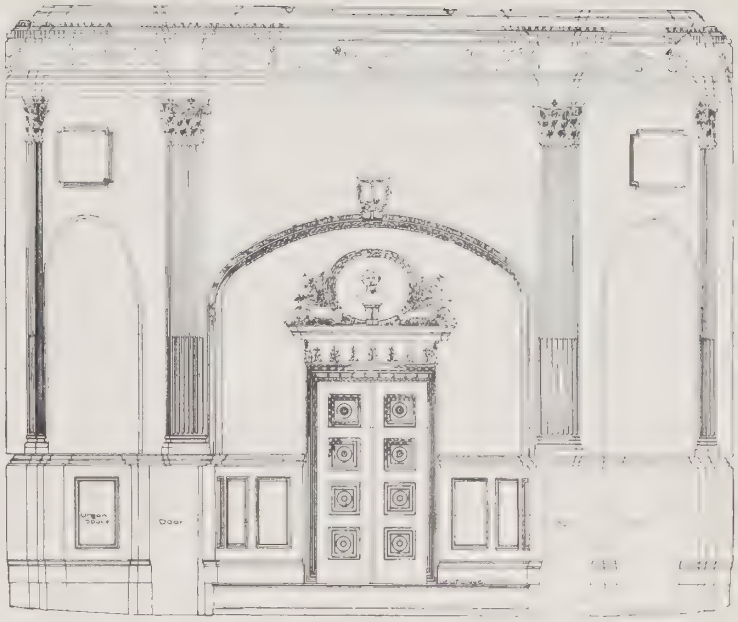
West Elevation
SCALE ¼ INCH = 1 FOOT

Scale of Feet ~ 0 5 10 15 20

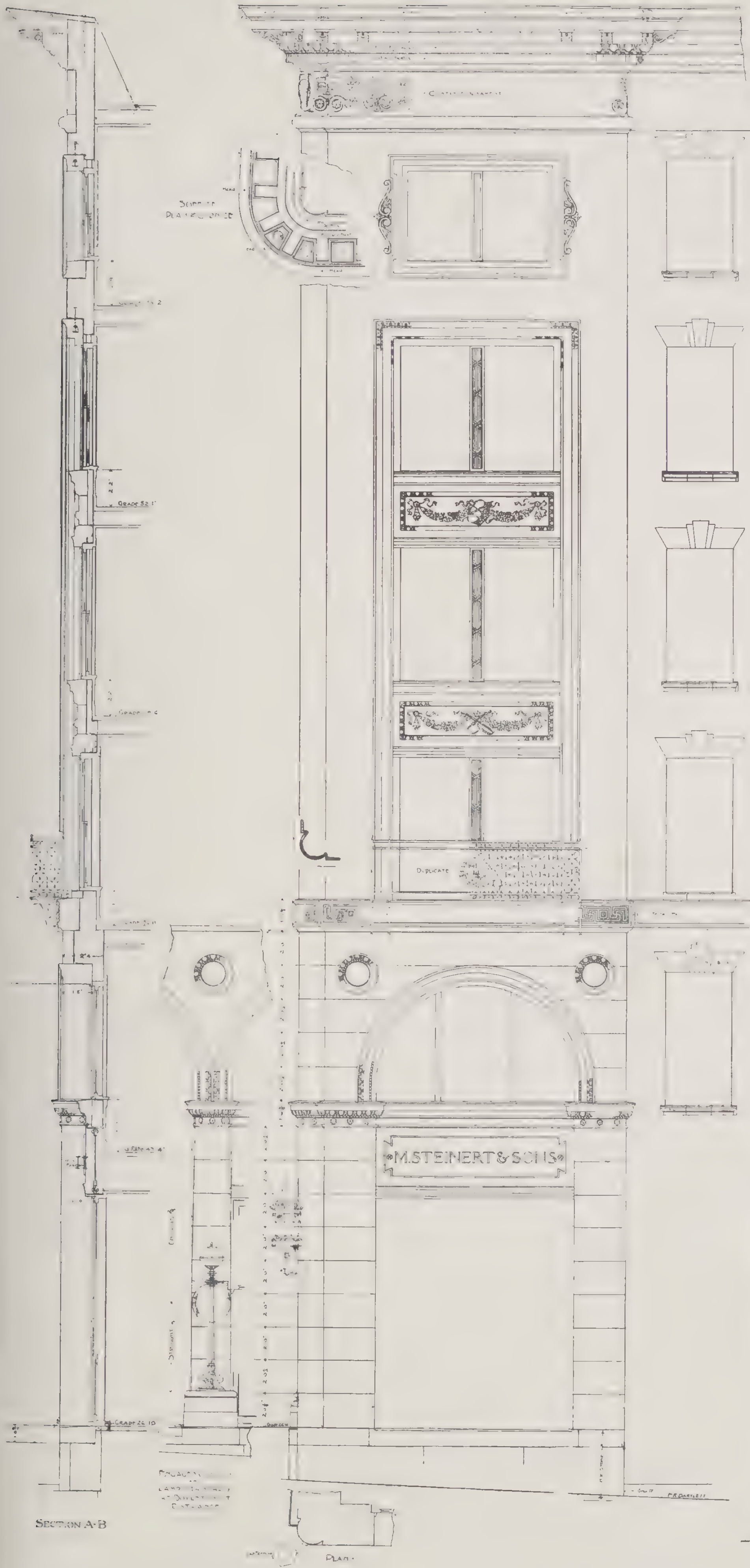

Ventilator
Ventilator
14 courses
6
Total = 79 Courses = 17'10" to under side of Plate.
24
4
11
4
6
10 courses
Centre Line of Openings
Centre Line of West and East Elevations
Sandstone
Sandstone
Finished First Floor Line
20 Courses in 4' Batter
These courses return in on jambs
This shows the bond at North-east corner. Others similar
Granite
Granite
Granite
Granite
Scale of Feet ~ 0 1 2 3 4 5

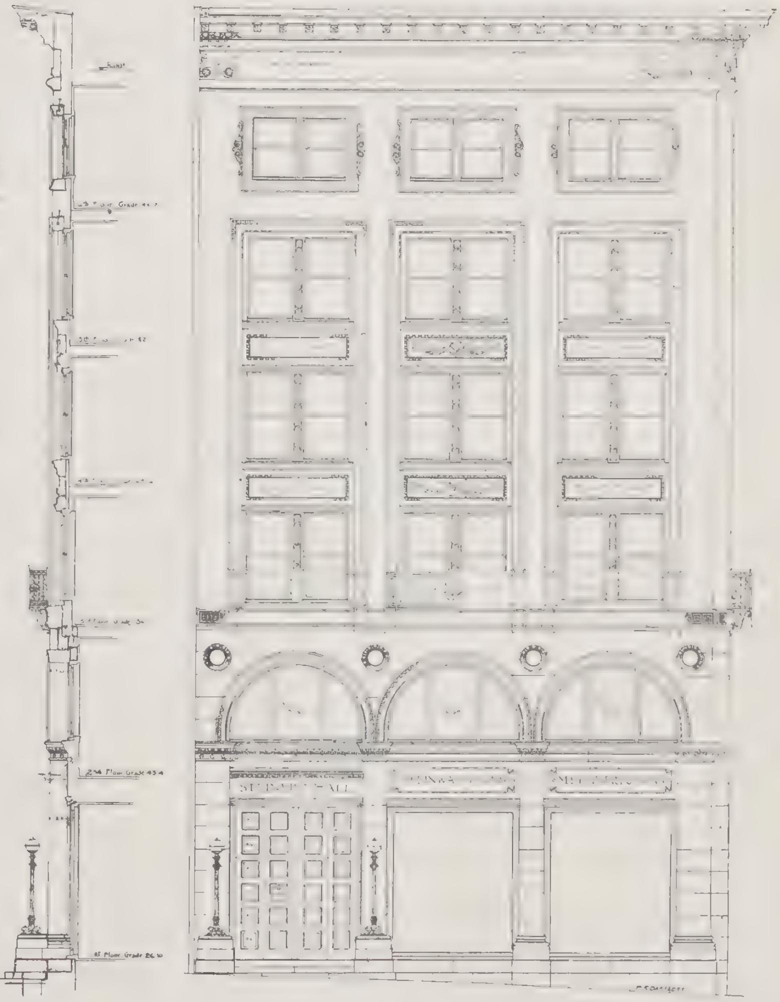
FIELD SHELTER, CAMBRIDGE, MASS.

ANDREWS, JAQUES & RANTOUL, Architects.



INTERIOR VIEW, LOOKING TOWARD STAGE.





FRONT ELEVATION,

STEINERT BUILDING, BOSTON. WINSLOW & WETHERELL, ARCHITECTS.

VOLVME
V
AUGUST
1896
No. 8

· THE ·
BRICKBVILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.
P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

STONE *vs.* TERRA-COTTA.

THE relative merits of stone and of the burnt clay products as building materials afford perennial opportunities for discussion, and the question is often raised whether the one is better than the other. We imagine that most builders and manufacturers do not appreciate how little the question of relative absolute worth is considered by the architect or by the owner of a building, and the warmest advocates of the one material or the other sometimes seem to be oblivious to the fact that building material is influenced very largely by much the same currents of opinion and usages which affect manufactured products of other descriptions, and that the demand arises far more from natural selection and the survival of the fittest than from the efforts of salesmen or the preference of individuals. An animated and at times acrimonious discussion has of late been taking place between two of our esteemed contemporaries, one being apparently unwilling to admit that stone in any form is suitable for building operations and even going so far as to hint that when anything but terra-cotta is employed, the decision is very largely due to direct or indirect bribery on the part of salesmen or dealers in stone, while the opposing journal more temperately denies the likelihood that either the terra-cotta or the stone men can bribe their goods into approval, but maintains that the only reason why terra-cotta is ever used in place of stone is because it is cheaper.

Now, without wishing to enter upon a discussion of this subject, we feel that there are very tangible reasons for our belief in the worth and desirability of the burnt clay products as building material. Many of our readers will remember the architectural throes of the period immediately following the Centennial Exhibition, when this country was beginning to awake to the fact that we had no architecture, although possessing high creative possibilities. For a time everything was designed in the Gothic style. We had Eastlake chairs, Gothic store fronts, Gothic shingle palaces, and our designer seemed to feel that one style and one method of construction would answer every purpose. Fortunately, the years have brought a wider range of professional discretion, and the intelligent designer of to-day endeavors to adapt the style to the purpose of the building, and within certain vaguely defined limits to permit himself a latitude in the choice of architectural expression. Exactly the same latitude is expected in the choice of material. While we believe that the burnt clay products are the best and the most suitable for nearly all structural purposes, there are cases where nothing but stone can be used to the best advantage. There are other cases wherein iron or concrete is the proper material to use, and the fact that the burnt clay industries have increased to the extent we now find them is due very largely to discrimination on the part of our architects, and the attempt persistently repeated to use materials in a proper, consistent, and well-advised manner. Brick cannot do everything, and terra-cotta does not fill every need. We can say this without the slightest derogation of its intrinsic as well as extrinsic advantages.

THE points peculiarly in favor of brick and terra-cotta as constructive materials are manifold. Brick is easily handled, requires little effort to put in place, can be readily repaired or altered, adapts itself to irregular contours, as well as to solid, massive construction, is absolutely fire-proof, and when properly made is impervious to the effects of the atmosphere. Terra-cotta, more than any other material, receives directly the touch of the artist. It can be molded into any shape with the greatest ease; it retains all the individuality of the designer, and, like brick, can be set with ease in any position. On the other hand, if we look over the building stones which are now in the market, there are hardly more than two which, in point of mere durability, can compare with thoroughly burned terra-cotta or brick. Only the best of the granites, and the Georgia marbles from the Tuckahoe quarries, can be entirely depended upon for all time. We know that sandstone disintegrates with time, and that limestone is affected by atmospheric acids, and no stone has yet been found which can be deemed to be safe against the action of extensive heat. This is recognized in some of the building laws of this country, which provide that wherever a stone pier is built below the grade of the street, it must be protected by a casing of fire-proof material, preferably of brick.

THE most rabid opponents of brick admit that the use of terra-cotta, iron, and other materials in the construction of buildings has increased, while in many places the use of stone has been at a standstill. The recent developments of skeleton construction could not have been brought about except for the possibilities of brick and terra-cotta. While stone is used a great deal in connection with the steel frames, every constructor and architect knows how difficult it is to make a thorough tie with stone about the structural members, and how doubtful the fire-proofing results are. On the other hand, brick fits into the webs and angles of the steel work, thoroughly protecting it, strengthening the whole by the cohesion of the parts, and at the same time permitting an amount of detail in design and decoration which, while it might be accomplished by the use of stone, would be much more expensive in the latter material and would certainly look no better. It must be remembered that the manufacture of thoroughly first-class terra-cotta is comparatively a modern achievement, and that while stone has been used in the best manner for centuries, we have only lately learned how to preserve a high grade of constructive excellence with wide range of artistic possibilities in the burnt clay products; and the fact that the use of terra-cotta and brick has steadily increased, in spite of the numerous failures which have had to be reported at times, and notwithstanding the quantities of poor bricks, soft terra-cotta, and positively bad workmanship which have been inflicted upon a long-suffering community, ought to be sufficient evidence that without any derogation to the artistic and practical uses of stone as a building material, the burnt clay products must have a great deal more to recommend them than the mere cheapness in first cost.

We must take exception to the inference drawn by one of our contemporaries that the stone buildings in the path of the tornado in St. Louis withstood the effects of the storm better than the brick structures. As a matter of fact, the tornado nowhere encountered any of the modern structures. The buildings destroyed were mostly cheap affairs, which could hardly be depended upon for ordinary emergencies. But if it came to an actual test, as between two modern steel skeleton buildings, one constructed with a facing of stone, the other with walls built throughout of brick or terra-cotta, the work in both cases being first class in every respect, a tornado such as occurred at St. Louis would undoubtedly wreck both; but the greater flexibility of the brick construction, as well as the fact that it ties and knits so thoroughly into the steel framework, would probably enable it to withstand an amount of wrenching which would shake off every particle of stone from the front of the other structure.

The fact is, the extended use of the burnt clay products has arisen as part of the enormous expansion of building through which this country has passed during the last quarter century, and brick and terra-cotta most fully answer our modern requirements. No one can dispute the artistic qualities nor practical advantages of stone, but its relative desirability as compared with terra-cotta is best gauged by a survey of recent architecture in any of our large cities, where a building completely of stone is the exception rather than the rule.

BUILDING CONSTRUCTION AND SUPERINTENDENCE.

By F. E. Kidder, C. E., Ph. D., Architect. Author of "The Architects' and Builders' Pocket Book." Part I., Masons' Work. Price, $4. New York: William T. Comstock, 23 Warren Street, 1896.

It is a difficult task to create a compendium of building construction if it is to be much more than local in its application, as the practise of building varies in many respects in different parts of our country; but Mr. Kidder has nevertheless managed to collect an exceedingly valuable mass of information relating to the general subject, which is put in such form as to make it immediately available for the purposes of architect and superintendent. The author's point of view is nearly always that of the architect rather than that of the contractor, but his deductions are none the less valuable on that account. The first volume, having to do entirely with mason work, includes a little over four hundred pages, accompanied by two hundred and fifty illustrations, and very thoroughly describes the different parts of the subject, dealing with foundations, limes, cements, and mortars, building stones, brickwork, terra-cotta, fire-proofing, steel work, lathing, and plastering, and concrete, with a very good chapter on specifications. The chapter on fire-proofing is especially good, taking up the subject thoroughly and illustrating the best developments thereof in the clear, concise manner which is characteristic of Mr. Kidder's work. He quotes very copiously from a mass of authorities all through the book, which, while making the work less personal, also increases its general value. Taken as a whole, this volume is the best treatise on the subject which has yet appeared in print, and comes nearest to being complete in its field.

ILLUSTRATED ADVERTISEMENTS.

The four terra-cotta figures that emphasize the salient angles of the tower on the Siegel-Cooper Building, Sixth Avenue, New York, are each made in one piece. They are 5 ft. in height, and weigh 1,400 lbs. each, but were taken from the kiln without a flaw of any kind. Our illustrations show two views of the same figure. They were modeled by Mr. L. Rochette, one of the staff of the New York Architectural Terra-Cotta Company, by which firm the whole of the terra-cotta used on this building was supplied.

In the advertisement of Charles T. Harris, Lessee of the Celadon Terra-Cotta Company, page xxvi, is illustrated the new residence of Justice H. B. Brown, at Washington, D. C., W. H. Miller, architect.

The Public Library, Boston, is the subject for this month's illustration, in the advertisement of the Boston Fire-proofing Company, page xii.

A view of the Munsey Magazine Building, now being erected at New London, Conn., showing the Guastavino system of fire-proofing, is shown on page xiv.

In the advertisement of F. B. Gilbreth, on page xxxv, three interesting views of details of the Lanesboro Gables, Roxbury, Mass., are shown.

The foundation course of this building is of Weymouth Seam Face Granite, furnished by Mr. Gilbreth. The effect of this material when used in this connection with brick is very clearly shown in the illustrations.

Messrs. Charles E. Park and Ralph E. Sawyer, of Boston, are the architects of the building.

The selection of the fifteen designs for which special prizes were offered in the Barta Press Competition had not been completed at the time of our going to press. The reason for this may perhaps be better understood when it is known that over two hundred designs were submitted in this competition.

PERSONAL.

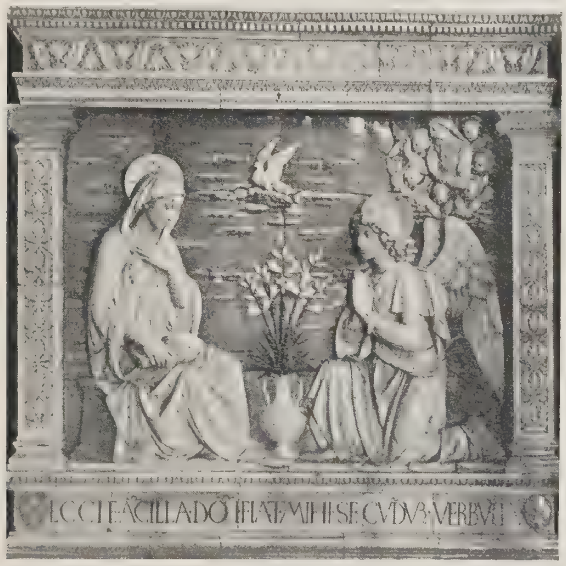
Messrs. Belden & Higginson, architects, Chicago, have moved their offices to 1001 Monadnock Block.

Messrs. Robert Burch and Logan Feland, Owensboro, Ky., have associated themselves under the firm name of Burch & Feland, for the practise of architecture. Catalogues and samples desired.

Andrea Della Robbia and His Altar-pieces.

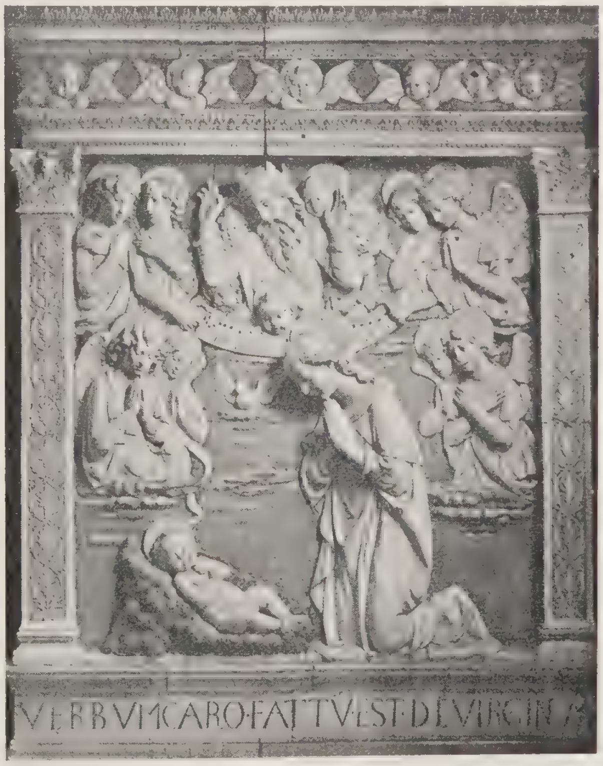
BY ALLAN MARQUAND.

OF the general characteristics which distinguish the work of the later members of the Robbia school from that of the elder Luca, perhaps the most striking is the extensive production of terra-cotta altar-pieces. It is a significant fact that we have no record of an altar-piece made by Luca della Robbia, and that Vasari, at the very beginning of his account of Andrea della Robbia, enumerates a number of altar-pieces as examples of his work. The meaning of this is that the new art of glazed terra-cotta, after having served architecture in a decorative capacity and having established its position in the field of independent sculpture, began now to encroach upon the sphere of painting. Or, if you choose, we may state the case from another point of view, and say that the essentially pictorial spirit of the Renaissance now began to pervade the sphere of sculpture. Painted panels and canvases did not suffice for the demands of remote monasteries and country churches. They required constant care and attention to preserve them from the injuries of the atmosphere, whereas a glazed terra-cotta altar-piece was proof against such injuries and required little or no care. One need not, however, be an expert to be able to see that in the matter of glazes there were great differences even in the Robbia school. All of Luca's work seems to have been glazed to perfection. Even that which remains out of doors has preserved its glaze to the present day, whereas the less perfect glazes used by Andrea and his school are of more perishable quality. Sometimes we see that the glaze has scaled off in large masses; sometimes we may rub it off by gentle pressure of the hand. It is sad to believe that this family secret, as it is usually considered, began to be lost even during the lifetime of its supposed inventor. Similarly, if we should take up one by one the other artistic qualities of the work of Luca, and trace them after his death in the works of the school, we should have in almost every instance the story of a decline.


LCCIE ACILLA DO FIAT MIHI SECVDV VERBVM

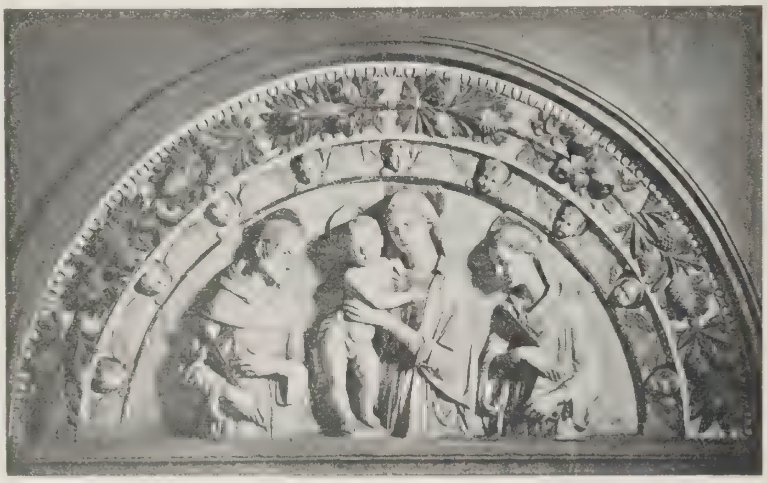
FAIENCE ALTAR-PIECE, "THE ANNUNCIATION," AT LA VERNA.

It is by no means an easy matter to obtain a consistent and satisfactory notion of the work of Andrea della Robbia, since the monuments which may be dated by documentary evidence belong exclusively to the later years of his life. At that time he required the assistance of his sons, and at least five of them followed their father's profession. It is reasonable to suppose that the best work of Andrea della Robbia would have been done before 1482, that is to say, during the lifetime of his uncle. And if we examine the series of works ascribed to him, a certain number, especially altar-pieces, may be set in the early class. These altar-pieces are found chiefly at Arezzo and La Verna. Vasari mentions some of them by name, and as he was a resident of Arezzo and personally acquainted with Andrea della Robbia, it is difficult to question his testimony. He mentions first the marble altar-piece at Ste. Maria della Grazie, a monument which is certainly in Andrea's later, not in his early manner. Next he mentions the altar-piece in the chapel of Puccio di Magio in St. Francesco, which in all probability is the highly polychromatic altar containing the Puccio coat-of-arms, and now in the cathedral. This altar-piece is probably earlier than the marble altar-piece at Ste. Maria della Grazie. It is a huge Conversazione or madonna and child enthroned between saints, like one of Giovanni Bellini's canvases transferred to glazed terra-cotta. Vasari enumerates more monuments, apparently at haphazard, but he seems here to have mentioned first the later works and then the earlier ones, perhaps the order of his personal preference. The charming Madonna sheltering the people of Arezzo, in Santa Maria in Grado, cannot be far removed in date from the lunette (dated 1489) over the door of the cathedral at Prato. About the same date may be assigned to the large Crucifixion altar-piece — the altar-piece at Arezzo — which formerly belonged to the Campagnia della Trinità. To Arezzo the student must certainly go if he wishes to secure a fair notion of Andrea's work. But if he wishes to see still finer products, he must make the pilgrimage to La Verna. Situated on a lofty mountain, here is one of the few monasteries in Italy which has not been suppressed. Evident prosperity reigns in this oasis amid barren hills. We may with comfort think of St. Francis and of his cave-dwelling as we walk over the spot where he is supposed to have received the *stigmata*. The church and its various chapels is rich in Robbia monuments. Some of them are late school products, and one catalogued with the Robbia monuments by Cavallucci and Molinier (No. 329) is actually signed Graziani, 1807. But the altar-pieces of "The Annunciation," "The Adoration," "The Crucifixion," "The Ascension," "The Madonna of the Girdle," and the figures in niches of St. Francis and St. Anthony are worth going a long way to see. In all these we can feel the inspiration, if not in some cases the actual handiwork, of Luca himself. "The Annunciation" angel reminds us of the


VERBVM CARO FATTV EST DE VIRGIN

FAIENCE ALTAR-PIECE, "THE ADORATION," AT LA VERNA.

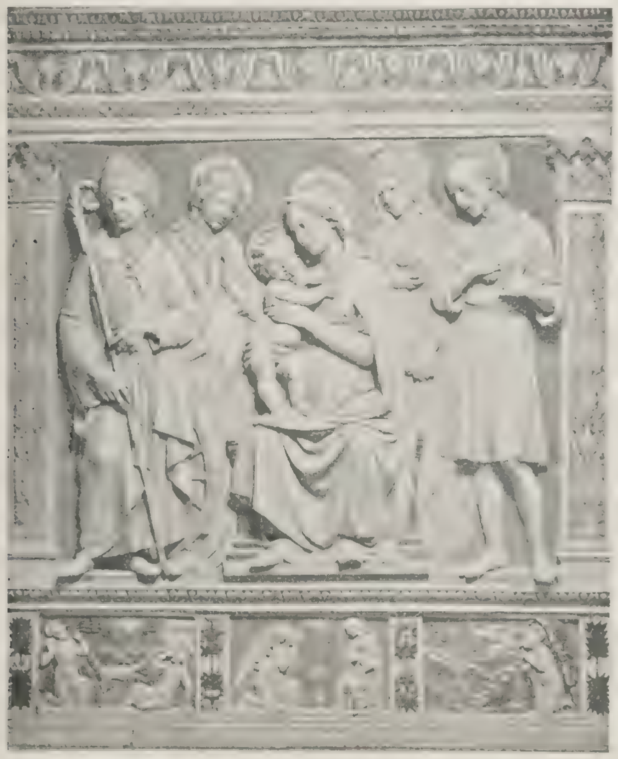
candelabra-bearing acolytes in the old sacristy of the cathedral at Florence, and the group of apostles in " the Ascension " takes us back to Luca's " Ascension " relief in Florence. There are many details, such as the refined design, the modeling of the draperies and the hair, the treatment of the eyes, the character of the inscriptions, which remind us so of Luca as to raise the question whether, after all, Vasari can be right in ascribing these monuments to Andrea. The same high quality is seen in the altar-piece at Gradara Rocca. Here the framework is somewhat conventional and repeats the motives used at La Verna, but in the painting of flowers in the predella Andrea shows the freedom of design which we admire in Luca's works. In his compositions, however, Andrea tends to become more and more conventional, and to value symmetry and balance above naturalness. One of the most charming altar-pieces of this early period is the " Coronation of the Virgin," in the Osservanza, near Sienna.



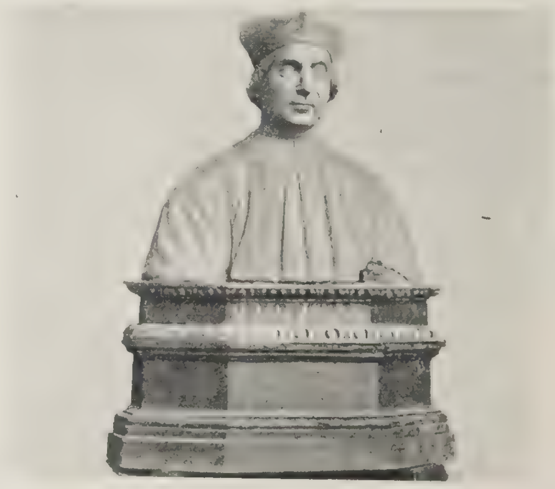
FAIENCE, LUNETTE, NOW IN VESTIBULE OF THE ACCADEMIA, AT FLORENCE.

From the year 1489 until 1515, the works which emanated from the workshop of Andrea della Robbia seem to have been very numerous. The lunette of the Madonna worshiped by two angels, now in the Opera del Duomo at Florence, is not a work of special merit. Yet the cathedral archives tell us that Andrea made it and received for it twenty florins. The lunette of the cathedral at Prato, on the other hand, which bears the date of the same year, is a work of real charm. The date is too late for us to think of Luca, but the style and handling of the work show us that Andrea did not leave this work to his assistants.

It is usually assumed that Andrea worked exclusively with white figures against blue grounds. This, however, is far from being the case. At Arezzo, besides the altar-piece mentioned by Vasari, we may note a polychromatic statue of St. Peter, martyr. At Borgo San Sepolero there are figures of St. Benedict and St. Romualdo, splendid examples of Andrea's best work. The lunette which we here reproduce of a madonna and child between St. Francis and St. Ursula, now in the vestibule of the Accademia at Florence, is certainly in the style of Andrea and yet is highly polychromatic. So are also the medallions on the loggia of St. Paolo. In 1505, Andrea was paid fifty gold ducats for the lunette of the madonna and child with angels, over the portal of the cathedral at Pistoja. We begin to see here that the hand of Andrea is growing feebler, but he is still an able sculptor, as we may judge by the somewhat monotonous but finely modeled ceiling for the porch of the same cathedral. Two years later, as recently discovered documents tell us, he made the lunettes at Ste. Maria della Quercia at Viterbo. In these he seems to have been touched by the Umbrian fondness for sentimental attitudes. His simpering saints and angels have lost much of the Tuscan grace and dignity that characterized the work of his earlier years. But this seems to have been a submission to the prevailing taste, for his bust of Almadianus, preserved in the museum at Viterbo, is not lacking in simplicity and dignity. The records at the church at Pian di Mugnone, outside of Florence, tell us that that church once contained figures by his hand representing " the Nativity." These seem to have been statues in the round, not figures in relief, and were polychromatic — an interesting example of the influence of similar Northern groups upon Tuscan sculpture. In the Ashmolean Museum, at Oxford, there are three unglazed heads classed as from this group, but we fail to see in them any trace of the style of Andrea della Robbia.



FAIENCE ALTAR-PIECE, AT GRADARA ROCCA.



FAIENCE BUST OF ALMADIANUS.

As compared with his uncle, Andrea was less inspired and less natural in his conceptions, and did not carry to the same degree of perfection either the art of modeling, glazing, or coloring. Nevertheless, if we may assign to him such an altar-piece as that in the Osservanza at Sienna, or such a lunette as that at Prato Cathedral, Andrea may be said to have surpassed his uncle in rendering grace and charm and the milder virtues.

Architectural Terra-Cotta.

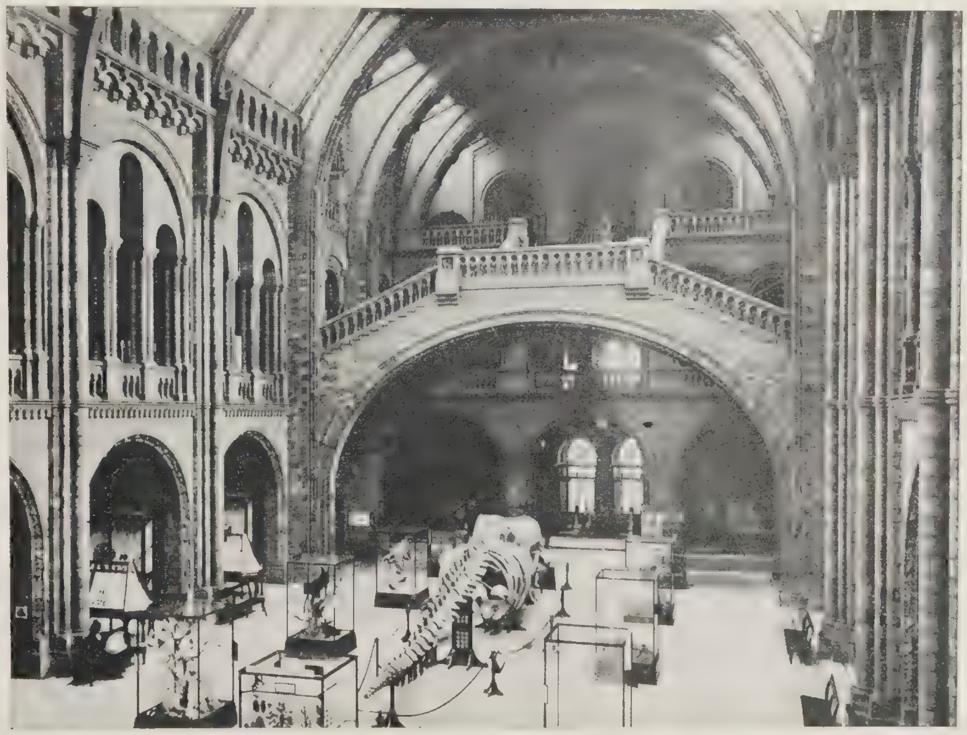
BY THOMAS CUSACK.

(*Continued.*)

A RECENT visit to the Natural History Museum confirmed the recollection of former ones made during its erection, and shortly after its completion. It likewise revealed many features of merit not previously observed, or, if seen at all, were not at that time sufficiently understood to be fully appreciated. The first and last impressions were like a young man's first reading of Shakespeare, compared with the oft-renewed studies of his riper years. Not the slightest suggestion of decay or deterioration is anywhere to be seen, and its freedom from extraneous discoloration is very remarkable. The deeply recessed windows, it is true, have received a share of the all-pervading smoke from the chimneys of over five million people, but the more exposed surfaces remain as clean and bright as when first built. The burning having been carried to the point of vitrifaction, the blocks were rendered practically impervious to dirt, and all that falls upon the face is washed off every time it rains. A man with a hose, and the occasional expenditure of a little water around the reveals and soffits of the arches, is about all that is necessary to make this the most cheerful public building in London.

The absolute uniformity of color, now so much talked of as the *sine qua non* of terra-cotta, was evidently not sought after on this building. We doubt whether it was desired, even if it could have been obtained; but whether intentional or otherwise, the blocks are *not* of uniform color. There can be no doubt that this, among other exigencies inseparable from the manufacture of terra-cotta, was taken into account when the selection of that material was being decided upon, for, in the present instance, the variation in color has been made to contribute towards a really picturesque effect. It was ever so with men of masterful mind. The most adverse circumstances have frequently been made to yield a positive advantage, not only in love and war, but in the prosaic, though hardly less heroic, pursuit of architectural terra-cotta treatment. Comparatively small-minded men have been known to work themselves into a state of anxiety bordering on frenzy on account of "uniform color," and often to the neglect of far more important considerations. We have seen much feverish excitement, and a corresponding waste of nervous energy on this point, in the case of a congeries of ordinary dwellings in New York City, or even on a commonplace block of apartment houses in a side street. Mr. Waterhouse did not fret his soul over this bugbear, though his great project was one of the first magnitude. He did not expect to receive in *terra-cotta* that which he was unable to obtain in stone, and which we in America cannot always secure in marble. Yet in the one case the architect was a distinguished academican, and in the other, perhaps an amateur builder, or a tenement-house speculator whose commercial instincts were the only ones that had reached normal development. It was one of this class who, having come into possession of a fine piece of antique furniture, sent it to a cabinet-maker to have it scraped, sand-papered, and repolished, and as he himself described it, made to look "spic-and-span." These men are really color-blind in an artistic sense, and their ideal happiness is only reached when they have obtained a lifeless, characterless uniformity at the cost of a glossy coat of lead paint. An evenness of color approaching that of stone is, of course, desirable, provided it "o'erstep not the modesty of nature," but this can be obtained by legitimate means, and in a way that is permanent, without the use of paint, or any of the empirical devices resorted to by latter-day alchemists.

The present method of slipping by means of compressed air had not been perfected when this work was being made, and the questionable expedient of *dipping* the blocks into a slip has never been encouraged by English architects. In the case under notice everything of that kind was expressly prohibited, and beyond a fluctuating tinge, that bears evidence of thorough, and occasionally of excessive firing, the surface is part and parcel of a homogeneous body. Its beauty is more than skin deep, and is not due to the "treatment" of Madame Recamiers' on the one hand or house painters on the other. From present appearances, it must be some time yet before Macaulay's New Zealander comes to sketch the ruins of the world's metropolis as seen from the remaining arch of London Bridge. But however graphically he may draw the condition of chaos into which a degenerate race must then have fallen, he will not have to record the "peeling off" of the slip, or the disintegration of these honestly made and solidly filled blocks of masonry. As already stated, and as may be expected, there is a wide range of color between the lightest and darkest blocks, if selected and placed in juxtaposition. But their distribution, though obviously accidental, is so regular in its irregularity, that when associated with others of medium tint, no extensive patches, and no studied patterns remain to mar what is now a really charming ensemble. The ashlar walling has the advantage of being jointed into relatively small blocks, and when viewed in connection with the immense scale of the building,[1] the individual components become more inconspicuous, and in a measure cease to assert any independent existence. The broad, general effect is a warm shade of buff, with bands and alternating voussoirs in dark gray, beyond which, one becomes conscious only of a subtle scintillating flicker of light and shade. The softening influences of time are making themselves felt, the laws of nature are lending a helping hand, and the harmony produced by the blending of varying tints is becoming



VIEW IN THE NATURAL HISTORY MUSEUM, LONDON.

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[1] By a typographical error in the June number, the frontage on Cromwell Road was given as 172 ft. It should have been 672 ft.

as agreeable to the eye as that of a well-trained orchestra is to the ear.

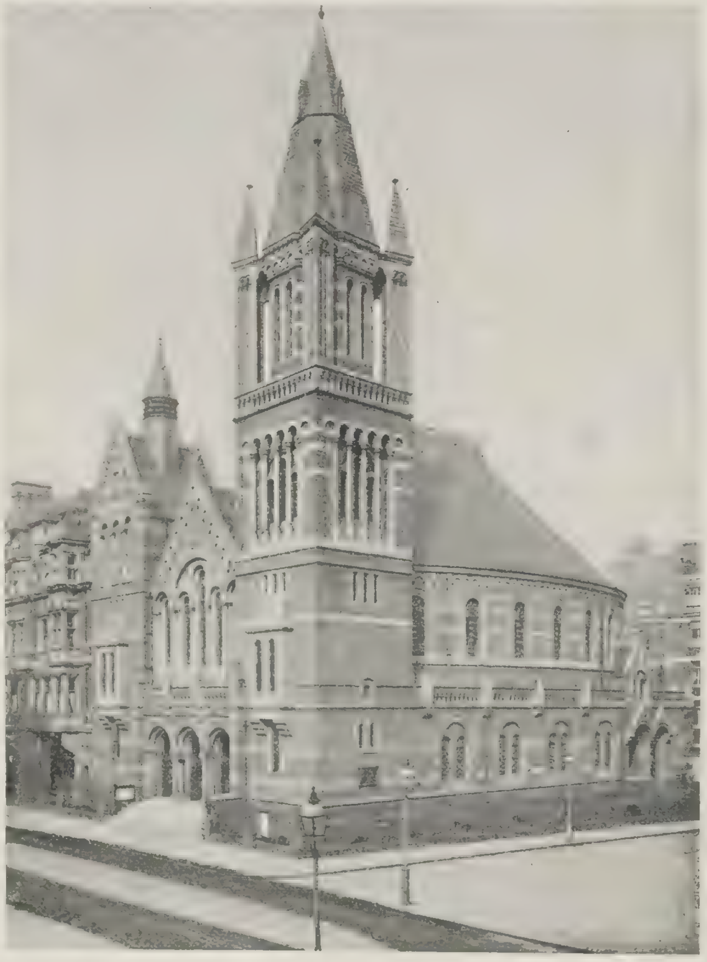
To the firm of Gibbs & Canning, of Tamworth, is due the credit for intelligent and well-sustained efforts displayed in the manufacture of this unsurpassed specimen of terra-cotta. It has been said that so far from realizing a fortune, they, in fact, expended one, in a conscientious endeavor to supply the architect, and the not less exacting British public, with the best that skill, perseverance, and unstinted outlay could produce. The original proprietors of these works are, we believe, all dead, and so cannot benefit from posthumous advertisement. But the firm, which is still in existence, though now in other hands, values the name of "Gibbs & Canning." There is, after all, something in a name; and the good reputation which these men earned by an unflinching fulfilment of their contract was evidently not interred with their bones.

Of the numerous important buildings on which terra-cotta has been used with marked success, and which owe their existence to Mr. Waterhouse during the past twenty years, we cannot give a full list, much less attempt a detailed analysis. The Town Hall, Hove, and the Hotel Metropole, Brighton; the City Guilds Technical Schools, Exhibition Road; the Prudential Assurance Building, Holborn Viaduct; and the Weigh-house Chapel, Duke Street, London. These representative buildings will be sufficient to show that terra-cotta has been deliberately chosen in preference to stone, in work of the highest class, and the results obtained will prove the adaptability of that material, as well as the versatility of the architect's treatment.

Let it not be supposed from this generalization that there is a single hackneyed repetition among them. The active, and apparently inexhaustible, brain of the man who conceived them, and watched over their growth as a father over his children, does not need to use the same set of ideas a second time. Whether built for national, municipal, commercial, or ecclesiastical purposes, and whether inspired by Norman, by Gothic, or by Renaissance precedents, the rendering is free, but not extravagant, progressive without being revolutionary, and art goes hand in hand with utility. Each one of them has its own individuality, growing out of its own plan, conforming to certain known wants, and indicative of a specific purpose. The one thing that does not change is the evident and unfailing mastery which the architect exercises over his material. Of all other members of his profession — and by their work we are acquainted with a great number — his practical knowledge of terra-cotta appears the most "extensive and peculiar." Whether this comes to him intuitively or otherwise we know not, nor do we presume to inquire. It is sufficient to know that he has it in full measure, and that it is the real secret of his remarkably successful results.

This knowledge, of course, becomes all the more serviceable from being interwoven with an unusually wide and varied experience as an architect and the creative genius of a true artist — a combination rarely met with in the same man, and one to be prized in proportion to its apparently increasing rarity. But whether as gifts or acquirements, these qualities afford him facility, discrimination, and decision in the unfettered use of a material in which success or failure depends, in an exceptionable degree, upon the use that is made of it. It is for this reason that we regret the present limitations of space, and the comparative inadequacy of the illustrations. The subject certainly calls for a fuller consideration, with special reference to these and other buildings, which would be of an educational value as object lessons.

As it is, we have been obliged to confine ourselves chiefly to the one admirable and enduring example cited in a previous chapter. But as the greater includes the less, so let it be with the Natural History Museum. In it all the others are concentrated, and in a measure typified, and in it the personality of the architect seems so indissolubly associated with his work, that we cannot think of the one without recalling the existence of the other. We hope, however, that what has been said may give rise to further inquiry, and perhaps lead to an inspection of the buildings themselves by a greater number of those interested in the use, or engaged in the manufacture of terra-cotta. We can assure those to whom these remarks are addressed; whether architects, draughtsmen, or architectural clay-workers, that a critical analysis of the examples which have been quoted would be to them a liberal education. In this particular line of study it would be but another way of casting bread upon the waters, to be found again in many days.


WEIGHHOUSE CHAPEL, DUKE STREET, LONDON.

In tendering this advice, let it not be supposed that we are seeking to uphold the doctrine of any man's infallibility, or asking them to accept as gospel truth everything that may be seen, even in work of the most unmistakable merit. Still less would we suggest anything tending in the direction of mere slavish imitation. Literal, flagrant, and unabashed copyism is already too prevalent amongst us. Not only do we steal from the living and the dead, but what makes these sins more heinous, good things are too often spoiled in the stealing. Every calling has its quota of Pecksniffs, but offenses of this kind are not confined to that class, nor are they sufficiently discountenanced by architects of otherwise respectable standing. On the contrary, they are systematically practised, and reduced to a sort of office routine by architectural bureaus claiming a high professional reputation. There is, however, such a thing as the legitimate study of *modern* as well as of ancient examples, and in this the efforts of contemporary workers should not be overlooked. Instances of what to do, and how to do it, as well as what to avoid, and how not to do it, abound on every hand. To an eye accustomed to discriminate, the negative side is quite as instructive as the positive. A candid comparison between one's own efforts, and those of fellow-workers engaged on similar problems is also useful. Though not always conducive to self-esteem, it is none the less a safe guide, and an inexpensive way of fixing a broader and higher standard of excellence.

The vexed question of jointing and of construction applicable to terra-cotta will be treated specifically in subsequent chapters, but before passing from this building we cannot do better than direct attention to it, as affording in this respect a number of practical examples that have few equals. The adjoining reproduction of recent photographs, taken by the writer, will show, among other things of interest, that no attempt has been made to conceal the joints. Neither have they been unduly emphasized, but frankly treated as a necessity, and recognized as a legitimate feature in the design. Even in the interior of the building the joints are a full quarter of an inch, and though viewed in trying contrast with adjacent cabinet-work, etc., the effect is all that could be desired.

(*To be continued.*)

BARTA PRESS COMPETITION. JUDGES' REPORT.

THE Designs for Borders sent in competition for the prize offered by the Barta Press are disappointing, inasmuch as they show very little actual knowledge of the first principles of blocking out and composition of designs for borders or belts.

Borders and belts are but little advanced beyond the most rudimentary types of design. The possible motives that can be used in them are comparatively few, and the value of the design is proportionate to the skill with which these motives are developed.

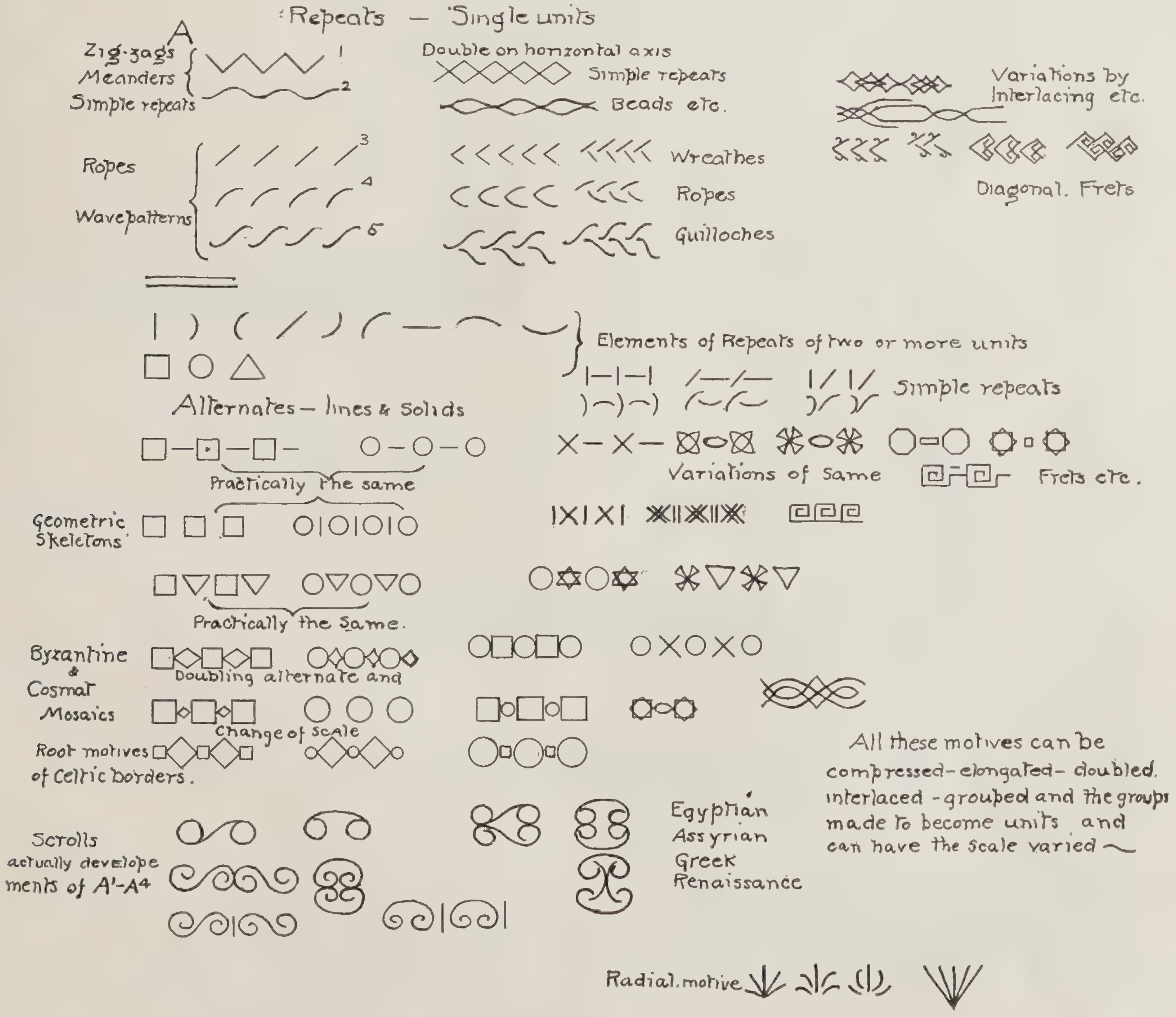
The following root schemes will be found to exhaust the possibilities of border motives which is really a subdivided triangle, and the possibilities for simple border design schemes are exhausted.

Very few of these motives, however, appeared in the designs submitted, and no facility in the use of these elements of design appeared.

And the possibilities of further development of border designs beyond these mere rudiments do not seem to have occurred to the designers. Contrast has been ignored, auxiliary parallel borders neglected, and parallel borders which occasionally approach each other and knot together, forgotten.

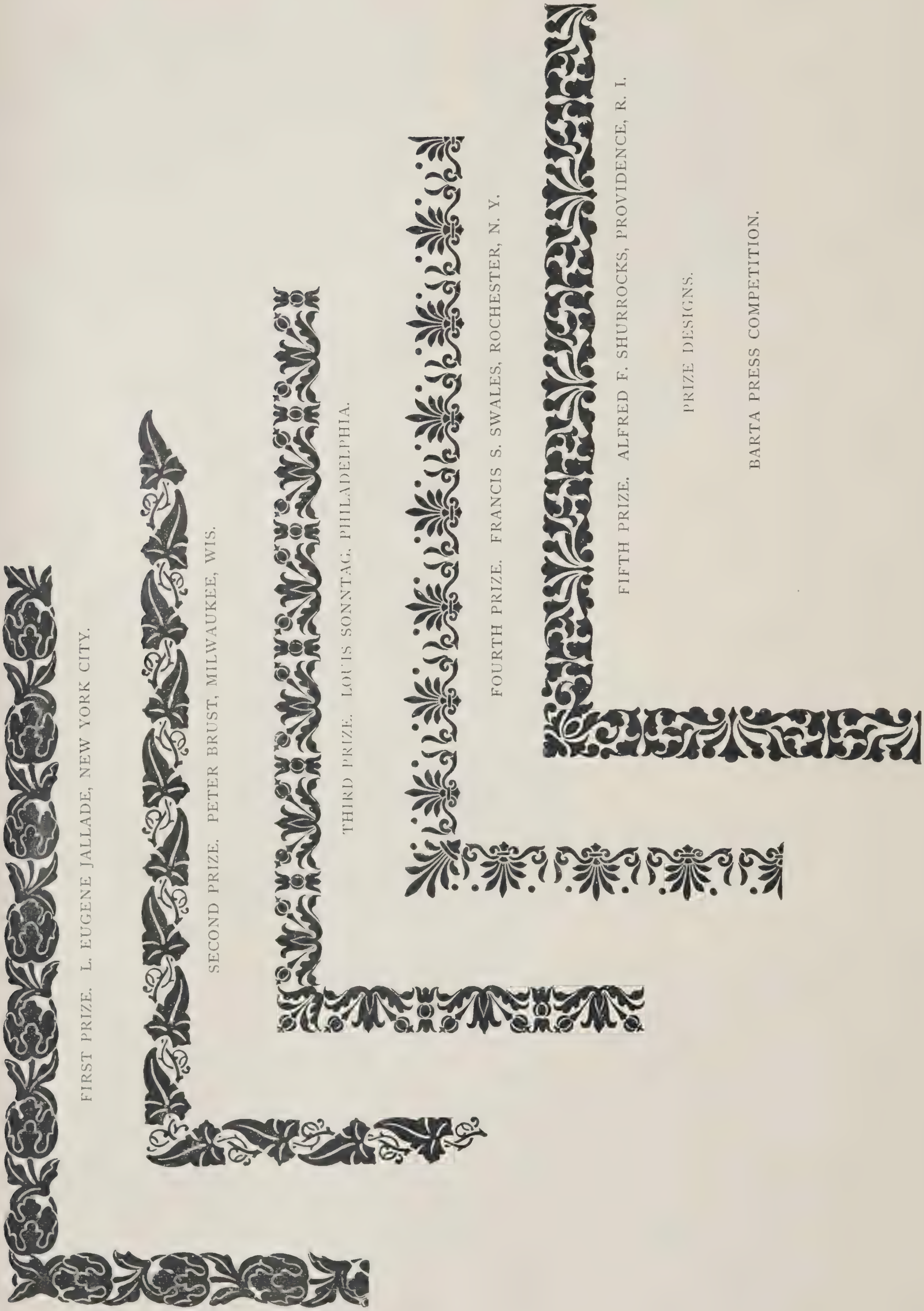
The units used are in most cases of the most ordinary description, without character of line or mass. By far the largest proportion of the designs are monotonous. No evidence is shown of knowledge of the very beautiful border designs of Byzantine work, of the designs during the early days of wood engraving, and of Celtic borders. There is no single design that has rich quality, and very few that are more than impoverished. It is admitted that many of these designs are better than those in use in presswork, but none of them are worthy of the prizes offered.

C. HOWARD WALKER,
R. CLIPSTON STURGIS,
BERTRAM G. GOODHUE,
} *Committee.*


Repeats — Single units
A
Zig-zags
Meanders
Simple repeats
1
2
Double on horizontal axis
Simple repeats
Beads etc.
Variations by Interlacing etc.
Ropes
Wavepatterns
3
4
5
Wreathes
Ropes
Guilloches
Diagonal. Frets
Elements of Repeats of two or more units
Simple repeats
Alternates — lines & Solids
Practically the same
Variations of Same
Frets etc.
Geometric Skeletons
Practically the Same.
Byzantine & Cosmat Mosaics
Doubling alternate and
Change of scale
Root motives of Celtic borders.
All these motives can be compressed-elongated-doubled. interlaced -grouped and the groups made to become units and can have the scale varied ~
Scrolls actually developements of A^1-A^4
Egyptian
Assyrian
Greek
Renaissance
Radial motive

BARTA PRESS COMPETITION.

PRIZE DESIGNS.



FIFTH PRIZE. ALFRED F. SHURROCKS, PROVIDENCE, R. I.

FOURTH PRIZE. FRANCIS S. SWALES, ROCHESTER, N. Y.

THIRD PRIZE. LOUIS SONNTAG, PHILADELPHIA.

SECOND PRIZE. PETER BRUST, MILWAUKEE, WIS.

FIRST PRIZE. L. EUGENE JALLADE, NEW YORK CITY.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

THE NEW YORK FIRE-PROOFING TESTS.

OUR readers will remember that some time since, through concerted action from several sources, it was arranged to have a series of tests of fire-proof material, in New York City. The conduct of these tests was placed in the hands of a committee including representatives from the Architectural League, the Tariff Association, and the American Society of Mechanical Engineers, to which were later added an advisory board, including a number of the best-known architects, engineers, constructors, and insurance men. The committee has recently presented its report of the first series of tests, which were made upon five columns, each from 12 to 15 ft. long, one column being built up of two steel channels and two plates, with a combined sectional area of 15 ins.; another being built up of four steel Z's and a plate, while the last three were of cast iron. For the purpose of the test, a brick furnace about 12 ft. square was built, the several columns being placed erect within it and subjected to a pressure from an external hydraulic ram so as to reproduce somewhat the conditions of load as they occur in practise. The furnace was heated by gas and free naphtha to temperatures varying from 1,000° to 1,300°. The columns were exposed directly to the heat without any fire-proofing whatever, the first column, composed of channels and plates, failed by crumpling after an exposure of thirty-five minutes to the high temperature with a load of less than half its safe carrying capacity. The yielding, however, took place almost as soon as the metal began to show red. The Z-bar column was exposed to the heat of from 1,000° to 1,375° for eleven minutes under very nearly its full safe load before the metal yielded by crumpling. Of the cast-iron columns, one sustained about its full safe load for thirteen minutes and another for seventeen minutes without bending. The last column tested was repeatedly heated to over 1,000°, and then cooled by water being thrown on it, the column all the while sustaining nearly its full load. It finally yielded, after about seven minutes' exposure to a temperature over 1,000°. The cast-iron columns were 8 in. diameter, of 1 in. metal, and judging from photographs of the test, yielded by bending, as a whole, a little below the center, the fourth column fracturing where the lateral deflection was the greatest. These tests were not made by the committee with a view to determine the fire-resisting qualities of steel and iron so much as to serve for a basis of comparison with subsequent series of tests. Tests of this kind made upon the bare metal are not of very great constructive values, as such conditions would hardly ever occur in a properly constructed building. Still the results are of considerable comparative interest, and they seem to show that the strength of either steel or iron is not materially affected so as to fall below its safe resistance until the temperature is raised above 1,000°, and that the metal can be trusted not to yield with a load of about six tons per inch until it becomes heated to dull redness.

Three subsequent series of tests have been arranged for by the committee; first, of unprotected beams and cast-iron columns protected with different materials and in different ways; second, of unprotected beams and girders; third, of protected beams and girders. It is also proposed that each series be provided with tests, both with and without water.

To the Editor of The Brickbuilder: —

Your article entitled "Expert Fire-proofing Engineers," in your April number, has just been brought to my notice. I am surprised that any American architect should send you a communication (on which your article is based) "calling attention to the fact that there is no generally recognized authority in this country on fire-proof construction, and suggesting that an expert fire-proofing engineer would not only fill a long-felt need, but would find ready employment for his talent in connection with our large commercial buildings," and I am equally surprised at the conditions you give for the qualifications of such an expert.

My first surprise is that any architect should ever have waked up to make the inquiry, and to explain it I must needs be personal. Three years ago, after having published a series of illustrated articles in the *Inland Architect*, entitled "Recent Fire-proof Building in Chicago," on invitation of the committee of arrangements of the American Institute of Architects, I prepared and read before the "World's Congress of Architects," at Chicago, a paper entitled "Fire-proof Construction and the Practise of American Architects." This was printed in several architectural papers, and by the Institute in its "Proceedings" for 1893 (which has no index), commencing at page 302. This paper was intended as a sort of *résumé* or *finale* to my series of articles in the *Inland*, and its whole tenor and object was to answer the query now made by your correspondent, and reiterated in your article in the April number. I had practised architecture in New York and Chicago from 1860 to 1880, had been an active contractor for fire-proof work from 1880 to 1891, and had resumed my practise as consulting architect for the immediately preceding two years. So at that time I had no interests in any system of fire-proof construction, to the study and practise of which I had devoted the better part of my life. The main objects of the paper were to warn my professional brethren against the pitfalls that lay in their way and some of the fallacies in connection with so-called fire-proof construction, as well as of the importance of consulting experts in fire-proofing as well as those on construction, sanitation, etc. I did not offer myself as a candidate, as it was well known that my practise had been largely as consulting architect, both before and after my experience in contracting. Now here is why I am surprised after reading your article. *From that day to this I have never been consulted, asked a question, or heard of any one else having been consulted on the subject.* I have therefore come to the conclusion that no such person is wanted. But if any one wants to know my views farther, he can read my paper, which he can do without expense, and I would particularly call his attention to pages 308 and 309, "Proceedings of the Twenty-seventh Annual Convention of the Institute." I think it would do no harm if you should print this or the whole of my paper, for I have not yet met any one who has read any of the four hundred pages of the "Proceedings" of that year.

My second surprise is that in giving your opinions as to the proper qualifications of such an expert, you repeatedly say that he should be a young man and omit the qualification of *experience*. I think it was Edmund Burke who said: "I am accused of the unpardonable crime of being a young man." Now, I do not think, with Burke's traducers, that there is any harm in being a young man. I was a young man a long time ago, and am not very old now; so I remember how it feels. I will not disparage youth, for I made my greatest success at twenty-two, but I am afraid that the American architects who are in want of light now will be tired of waiting until the young man you suggest has completed the four years' course of study that you recommend.

I am equally surprised that your correspondent, who I see is a Chicago man, was not aware that I have no interest now with any manufacturing or contracting company. Peter B. Wight.

At the time the editorial referred to was written, we did not know that Mr. Wight had more than nominally severed his connection with the firm of fire-proofing contractors with which he had been for so long a time identified, and we supposed he was still in a semi-official capacity acting as their advisor. We do not believe that a long business association with a particular manufacturer of patented fire-proofing material is in all respects the best preparation which a prospective fire-proofing engineer could have; but we are very glad to acknowledge our oversight and to testify to the high character of the work with which Mr. Wight has had to do, and to the extent to which he has raised the standards of fire-proof construction. We know of no one who is, on the whole, so thoroughly qualified in this particular line; and when we consider the amount of ill-contrived, poorly executed work which has found expression in this country, we can but regret, with Mr. Wight, that there should seem to be so little disposition on the part of those immediately interested to put fire-proofing under the immediate direction and control of a trained expert. — *Ed.*

A NEW FIRE-PROOFING SYSTEM.

WE have received from Mr. George Rushforth, architect, of Stockton, Cal., drawings which we publish herewith, showing a system of fire-proofing devised by him. The floor is constructed with steel I-beams spaced three feet on centers, connected by hollow terra-cotta blocks. The skew-backs or beam tiles are made to fit around the webs and lower flanges of the beams, being placed parallel thereto. Between these are fitted the terra-cotta end blocks or lintels, butting directly on the beam tiles. By using tile lintels of different depths a paneled ceiling can easily be constructed with this system, as is shown by drawings. The wood centering which is found necessary in setting the hollow terra-cotta floor blocks most commonly employed can, with this system, he entirely dispensed with. For variations in the spans between beams, the lintel blocks can be cut down in length by hand.

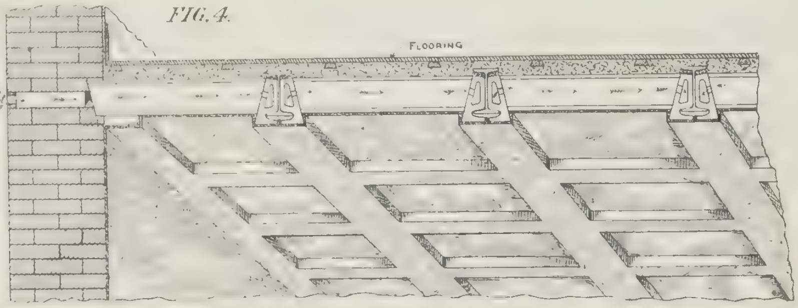
The inventor of this system places considerable stress upon the claim of added security afforded by air being allowed to circulate freely through the terra-cotta work and round the iron beams, which is an essential feature of the construction. For this purpose air ducts are left in the exterior brick wall of the building communicating with the hollow spaces in the tiles, and holes are left in the beam tiles so that the air can be carried around the flanges of the beams. As soon as a fire begins to heat any portion of the floor, it is claimed that a rapid circulation of air is created, and that the cold air would rush to the heated place and tend to distribute the heat throughout the system.

GOLD AND SILVER PRODUCT COMPARED WITH FIRE LOSSES FOR TWENTY YEARS.

IN a review of some of the causes of the present business depression and resulting hard times, the New York *Chronicle* calls attention to one cause not usually taken into consideration in discussing the situation. This factor is the fire loss of the country, which, while to a considerable extent met to the losers by the insurance companies, is in the end an absolute annihilation of wealth. The *Chronicle* gives a table, showing a comparison of the fire losses during a series of years, with the annual production of gold and silver in this country, which presents the matter in a striking aspect. The important portion of the table is as follows : —

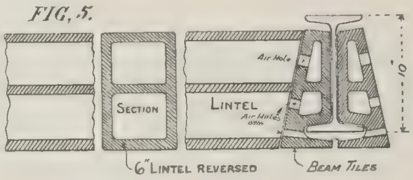
YEAR	Gold and Silver.	Fire Loss.	Difference.
1875	$65,100,000	$78,102,285	$13,002,285
1876	78,700,000	64,630,600	14,069,000
1877	86,700,000	68,265,000	18,434,200
1878	96,400,000	64,315,900	32,084,100
1879	79,700,000	77,703,700	1,996,300
1880	75,200,000	74,643,100	556,600
1881	77,700,000	81,280,900	3,580,900
1882	79,300,000	84,505,024	5,205,024
1883	76,200,000	100,149,228	23,949,228
1884	79,600,000	110,008,611	30,408,611
1885	83,400,000	102,81 ,796	19,418,796
1886	86,000,000	104,924,750	18,924,750
1887	86,350,000	120,283,055	33,933,055
1888	92,370,000	110,885,665	18,515,665
1889	97,446,000	123,046,833	25,600,833
1890	103,310,000	108,993,792	5,683,792
1891	108,592,000	143,764,967	35,172,967
1892	115,101,000	151,516,098	36,415,098
1893	112,531,000	167,544,370	55,013,370
1894	103,500,000	140,006,484	35,506,484
Totals	$1,783,200,000	$2,077,390,258	$294,190,258

FIG. 4.



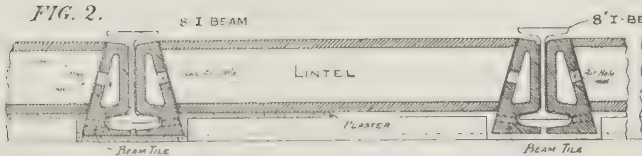
PANELLED CEILING FORMED BY USING TWO SIZES OF LINTELS.

FIG. 5.



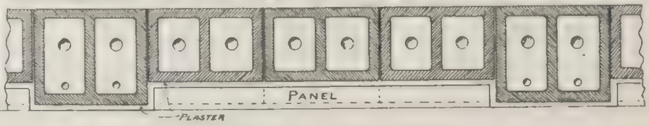
HOLLOW TILING FOR 10" I BEAM

FIG. 2.



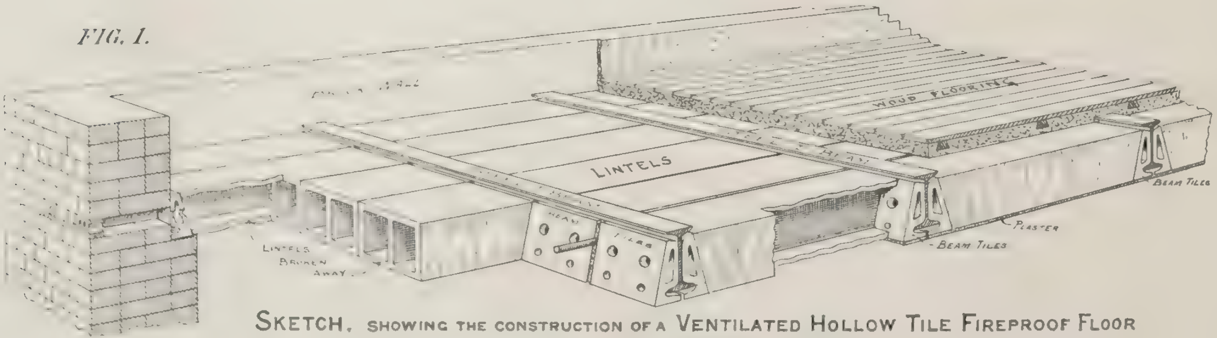
SECTION OF BEAM TILES

FIG. 3.



SECTION OF LINTELS (TWO SIZES)

FIG. 1.



SKETCH, SHOWING THE CONSTRUCTION OF A VENTILATED HOLLOW TILE FIREPROOF FLOOR WITH 6 INCH I-BEAMS AND TILES.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING. (*Continued.*)

SPECIFICATIONS governing cement tests, derived from various authentic sources, are herewith given: —

U. S. Engineer Office,
Portland, Maine, Feb. 14, 1893.

Peter C. Hains, Lieut.-Col. of Engineers.

The cement is to be hydraulic, uniform in quality, fresh, dry, finely ground, free from lumps, and put up in good sound barrels, each barrel of cement to weigh not less than 300 lbs. net. A sample is to be submitted for test, and the entire quantity delivered must be fully up to the sample.

The cement must not set within twenty minutes. Briquettes made of neat cement, mixed with a proper proportion of water, must show a tensile strength per square inch of not less than 60 lbs. after exposure to the air for twenty-four hours; kept one day in air and six in water, not less than 100 lbs.; and kept one day in air and twenty-seven in water, not less than 180 lbs.

At least 90 per cent. must pass through a sieve of 2,500 meshes to the square inch.

The cement will be subjected to such other tests as the engineer may deem necessary.

U. S. Engineer Office,
Army Building, 39 Whitehall Street,
New York, N. Y., Jan. 25, 1893.

G. L. Gillespie, Lieut.-Col. Corps of Engineers.

The cement will be of first quality American cement, fresh, dry, full weight, finely ground, free from lumps, and put up in good sound barrels.

The bids will state the special brand proposed to be furnished, and the bidder will deliver a sample barrel upon Pier 3, East River, for test, at least ten days before the opening of the bids.

The cement will be expected to stand the following tests: Cement neat must be set in about thirty minutes, and have tensile strength per square inch as follows: —

Samples which have been kept in air and broken at twenty-four hours after setting, 70 lbs.; at seven days, 125 lbs.; at fourteen days, 170 lbs.; and at thirty days, 225 lbs.

Samples which have been kept twenty-four hours in air and then in water until broken: at twenty-four hours, 70 lbs.; at seven days, 90 lbs.; at fourteen days, 120 lbs.; and at thirty days, 150 lbs.

Cement one part, sand two parts, tensile strength per square inch, samples kept in air until broken: at twenty-four hours, 15 lbs.; at seven days, 35 lbs.; at fourteen days, 50 lbs.; and at thirty days, 65 lbs.; and immersed in water twenty-four hours after setting: at twenty-four hours, 15 lbs.; at seven days, 30 lbs.; at fourteen days, 45 lbs.; and at thirty days, 65 lbs.

U. S. Engineer Office,
Custom House, Pittsburgh, Penn., July 31, 1894.

Capt. R. L. Hoxie, Corps of Engineers, U. S. A.

AMERICAN HYDRAULIC CEMENT.

Inspection.— Ten per cent. of the packages in each car-load, and no more, will be selected for weighing and testing. The net weight and quality of all cement in each car-load will be determined by weighing and testing these selected packages. The average net weight of all packages in each car-load lot will be the average net weight of all the selected packages. The failure of any one of the selected packages to stand the required tests will be sufficient reason for rejecting this car-load lot, excepting only those packages which may have stood the test. Rejected cement will be immediately reshipped to the contractor at his expense, and the cost of all handling of same will be charged against his account.

Fineness.— Ninety-five per cent. by weight must pass through a cement wire sieve having 2,500 meshes per square inch, and made of No. 35 wire, Stubb's W. G.

Preparation of Test Briquettes.— Cement will be mixed neat, with enough water only to thoroughly moisten and make it coherent, and will be pressed into the mold with a spatula. Temperature not below 60°.

Setting.— The surface must yield to the pressure of a wire $\frac{1}{24}$ in. diameter, carrying a weight of 1 lb. thirty minutes after completion of briquette.

Tensile Strength per Square Inch of Cross-Section. — This will be for each package the average strength of five briquettes. These will be kept in air until set, and then immersed in water until they are put into the clips of the testing machine, being tested wet. After twenty-four hours' immersion in water, the tensile strength must be 70 lbs., and after seven days' immersion, 125 lbs.

Checking and Cracking.— When made into a thin cake, allowed to set in air, and immersed in water, no checking or cracking must be shown.

Specifications for the cement used in the masonry of the depressed Harlem Railroad tracks in New York City.

The cement must be of the best quality of freshly burned and ground hydraulic cement. It will be subject to test made by the engineer or his appointed inspector, and must stand a proof tensile test of 50 lbs. per square inch of sectional area on specimens mixed to a stiff paste and allowed a set of thirty minutes in air and twenty-four hours under water; and of 90 lbs. on specimens allowed a set of seven days under water, and shall be 90 per cent. fine when tried with a sieve of 2,500 meshes to the square inch.

It must take not less than twenty-five minutes to bear the light wire — that is, a weight of 4 ozs. on a wire one twelfth of an inch in diameter.

The following specifications for hydraulic cement were drawn by a United States engineer who advertised for a large amount of cement and received but one bid.

The cement must possess the following requisites: —

First.— It must be fresh, slow setting, and so finely ground that 85 per cent. of it shall pass through a sieve of 2,500 meshes per square inch.

Second.— After being mixed neat and filled into a glass bottle, or similar vessel, and struck level with the top, it must not crack the vessel in setting, nor rise out of it, nor become loose in it by shrinkage.

Third.— When mixed neat and made up into briquettes, and given one hour in air, then twenty-three hours in water, the cement must be capable of withstanding a tensile strain of 35 lbs. per square inch before it is fractured; and after seven days in water, succeeding the first hour in air, it must sustain a tensile strain of 125 lbs. per square inch.

FOURTH.— Its initial setting shall not take place in less than thirty minutes from the time it is mixed neat into a paste.

FIFTH.— The cement must possess reliable uniformity of all these qualities.

It will be noted that these specifications state that "the cement must be fresh," and yet, "the initial set must not take place in less than thirty minutes."

It is doubtful if any brand of rock cement could fulfil all the requirements.

The following letter is in reply to an inquiry by the author: —

TREASURY DEPARTMENT,
OFFICE OF THE SUPERVISING ARCHITECT,
WASHINGTON, D. C., May 14, 1896.

Sir: — Replying to your letter of the 11th inst., you are informed that the requirements of cement to be used under this office are as follows: —

Hydraulic cement, mixed neat, one day in air and six days in water, should stand a tensile strain of 90 lbs. per square inch.

Portland cement, mixed neat, one day in air and six days in water, should stand a tensile strain of 350 lbs. per square inch.

This office has no printed forms governing the making of mortars and concretes; specifications for this class of work vary according to circumstances.

Respectfully yours,
(Signed) WM. M. AIKEN,
Supervising Architect.

1895.
DEPARTMENT OF PUBLIC WORKS,
PEORIA, ILLINOIS.

ALMON D. THOMPSON, CITY ENGINEER.

All cement for concrete foundations shall be what is commonly known as American Natural Hydraulic Cement, of quality equal to the best obtainable in the markets. All Portland cement used on the work shall be the best obtainable in the markets. They will be subjected to rigid inspection, and that rejected shall be immediately removed by the contractor.

The contractor must submit the cement for inspection and testing at least ten days before using, and such inspection and tests will be made only from samples obtained by the inspector from cement delivered on the work.

The inspector shall be notified of each delivery of cement. All cement must stand the following tests: —

Two cakes, 3 ins. in diameter and ½ in. thick, with thin edges, will be made.

One of these cakes as soon as set will be placed in water and examined from day to day. If the cake exhibits checks, cracks, or contortions, the cement will be rejected. The other cake described will be used for setting and color tests.

The time will be noted when the cake has become hard enough to sustain a wire $\frac{1}{12}$ in. in diameter loaded with ¼ lb.

When the wire is sustained, the cement has begun to set, and this time shall not be less than ten minutes for natural cement, nor less than forty-five minutes for Portland cement.

When the cake will sustain a wire $\frac{1}{24}$ in. in diameter loaded with 1 lb., the set is complete, and this time must not be less than one hour nor more than three hours for natural cement, nor less than two hours nor more than six hours for Portland cement.

The cake used for setting test will be preserved, and when examined from day to day must be of uniform color, exhibiting no blotches or discolorations.

The cement must be evenly ground, and, when tested with the following standard sieves, must pass at least the following percentages: —

	Natural.	Portland.
No. 20 sieve, having 20 meshes per lineal inch	100%	
No. 50 sieve, having 50 meshes per lineal inch	90%	98%
No. 74 sieve, having 74 meshes per lineal inch	80%	94%
No. 100 sieve, having 100 meshes per lineal inch		90%

The diameter of wire for sieves being respectively: —

For. No. 20 sieve, No. 28 Stubb's wire gauge.
For No. 50 sieve, No. 35 Stubb's wire gauge.
For No. 74 sieve, No. 37 Stubb's wire gauge.
For No. 100 sieve, No. 40 Stubb's wire gauge.

All cement for test briquettes will be mixed with barely sufficient water to make a stiff mortar.

The neat briquettes to be pressed into the molds by hand and the sand briquettes to be compacted by light tapping.

The sand for cement tests will be crushed quartzite of such fineness that all will pass a sieve of 20 meshes per lineal inch, and none of it a sieve of 30 meshes per lineal inch.

The required tensile strength per square inch shall be as follows:—

Neat Cement.	Natural.	Portland.
One day, till set in air, remainder of time in water	60 lbs.	150 lbs.
One week, one day in air, six days in water	150 lbs.	400 lbs.

CEMENT ONE PART AND SAND TWO PARTS.

One week — one day in air, six days in water . . 75 lbs.

CEMENT ONE PART AND SAND ONE AND ONE HALF PARTS.

One week — one day in air, six days in water . . 85 lbs.

CEMENT ONE PART AND SAND THREE PARTS.

One week — one day in air, six days in water . . . . . 140 lbs.

Briquettes for the seven-day tests shall be covered for the first twenty-four hours with a damp cloth.

(*To be continued.*)

THE strength of a concrete slab was recently made the subject of an interesting test at the laboratory of the Massachusetts Institute of Technology, Boston, Mass. This slab was a section of flooring designed to be used in a courtyard for a dormitory building, and which had to carry coal teams, etc. Brick arches had been specified for this floor, but on account of the lower bid for concrete flooring, the authorities decided to test it. In the test the slab was supported by four I-beams spaced 4 ft. 9 ins. c. to c. and was 5 by 14 ft. by 4 ins. with ¾ in. twisted steel bars spaced 6 ins. c. to c. and running lengthwise, and $\frac{3}{16}$ in. bars running crosswise, 4 ft. 9 ins. apart, or directly over each I-beam. The composition of the concrete was 1 part Alsen's Portland cement, 1 part sand, and 6 parts broken stone. The stone was crushed so that 2 parts passed a ½ in. ring and 4 parts a ¼ in. ring. Bricks were piled on in piers until a load of 16,770 lbs., or 724 lbs. per square foot, was obtained and a depression of $\frac{5}{32}$ in. resulted. This load of course covered only the span between two I-beams. Next an impact test, consisting of dropping a timber weighing 164½ lbs. endwise onto the slab 20 ins. from the nearest I-beam and from a height of 7 ft. 10 ins. was made without causing any break or damage whatever. The third test was for shearing, and consisted in thrusting with a screw-jack against an I-beam laid transversly across the slab about midway between the I-beams, until a pressure of 20,700 lbs., with a deflection of $1\frac{1}{32}$ ins., was obtained before the concrete cracked. By means of the same screw-jack a more local pressure covering an area of 1½ by 9 ins. was tried. When placed so as to bring the pressure over two of the twisted iron bars the load borne was 6,200 lbs., and over one bar 7,700 lbs. were carried. It is stated that several faults of construction entered into this slab, or else it would have shown still better results. — *Eng. News.*

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX.

METHODS OF ESTIMATING. (*Continued.*)

THE preceding paper was devoted to a brief analysis of the methods of estimating which are in general use, and it was shown that both architect and contractor, and consequently the owner, suffered each in his way under the system as described. Although there are many minor abuses on either side, the most serious one with which the architect has to contend is that of checking excessive charges or insufficient allowances; the contractor, on the other hand, is often obliged to base his estimates upon incomplete and defective drawings and specifications which are vague and general in their language. These evils, which are quite common even among some of the best architects and contractors, go hand in hand, that is to say, one is the result of the other; so the responsibility for this unsatisfactory condition of things may be safely said to be about equally divided between the architect and contractor. No reform can be made in a matter like this without a certain amount of concession from each side, and it would seem to be a fair proposition for the architects to say, "We will agree to present for estimate a set of drawings so complete that the quantities of all materials can be accurately determined, and specifications which will correctly and precisely describe the materials and the conditions under which the work must be executed, but in return you, the contractors, must place in our hands the means of settling for extra work and work omitted at the same rate at which similar work was figured in the estimate." If such an agreement could be reached, it could not fail to prove of the greatest benefit to all parties concerned in building operations, for it would at once remove the greatest factors of uncertainty which exist under the present conditions. If we turn to the method of estimating employed in England, we shall find, while it is probably too complicated to be introduced in its entirety, yet it contains many features which, in modified form, could be most profitably adopted into our practise here. And it is worth while to note, in passing, that for those concerned in such matters there is no more interesting and instructive reading than the English text-books, that country being much older than ours, extensive building operations have, of course, been carried on through a much longer period, with the result that many of the problems with which we are at present struggling have there been fought out and settled, and the new and unforeseen contingencies which are continually appearing with us to vex the architect or contractor have, in the older country, been met so often that they are now apprehended and provided for in advance. The thoroughness with which the English work is carried on necessarily involves an amount of detail from which the American architect and contractor would at first instinctively shrink. They would both of them think at first sight that it was more profitable to shirk the added work and trust to luck; but if such safeguards as exist in the older countries could once be adopted here, they would do away with most of the friction which now occurs, and would relieve us of many of the worries and vexations which now make our work so wearing, and the results often so unsatisfactory.

The English method of estimating is briefly this: After the architect has prepared the plans and specifications, they are given to a quantity surveyor, whose duty it is to make an accurate bill of quantities, tabulated in such form as to enable the contractor to place opposite each item its value, the sum of these items making the estimate for which he is willing to undertake the work. Within a week of signing the contract the contractor is usually required to deposit with the architect "a full-priced copy of the estimate," and one of the general conditions of the specifications read, "extras and omissions to be valued at the price of the contract, and any item of extra work which does not exactly agree with the descriptions of the original estimate to be valued at a price analogous thereto." It can be readily seen that this method strikes at the root of our greatest evils. No sworn surveyor whose reputation is at stake would put his name to a bill of quantities unless it were, to the best of his knowledge, accurate — and no accurate bill of quantities can be made unless the drawings and specifications are complete and definite. On the other hand the architect is assured that the fair market value will be allowed for extras and omissions, and it cannot be denied that with these two matters, so productive of delays, complications, and disagreements, settled, that both the architect and contractor would find opportunity to devote themselves to many essential things in connection with their work which are now neglected for want of time. The quantity surveyor stands practically as an arbitrator between the architect and contractor, and his compensation, two and one half per cent., is ample to secure the employment of a competent person; he is paid by the owner, so there is no reason, on the ground of economy, to dispense with his services, and he is liable to the contractor for any proved inaccuracies in his work. The care and thoroughness with which the surveyor's work is done may be seen from the fact that three distinct operations are used to complete the work, namely: the "taking off," which consists in taking the amounts of the different materials with a description of the work; "abstracting," which consists of combining the quantities of similar kind and reducing them to the units in accordance with the custom of the trade; and finally "billing," which tabulates the quantities with descriptions and sketches in such a form that the contractor can place opposite each unit its value. The systems under which these different operations are carried on are such that there is but small liability that any item will be overlooked, and at the same time the work is so arranged that each item can be easily traced through the successive stages.

Nor are we dependent upon the English alone for precedents in this matter, for a similar method is employed in France, where the contractor figures the percentage of profit at which he is willing to undertake the work, the basis being a government list of prices which is amended from time to time.

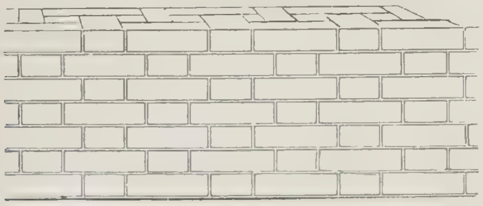
It has already been stated that it would probably be impracticable, if not impossible, to introduce the English method of estimating as a whole, but some of its salient features might well be adopted by us, and would undoubtedly improve our system as practised at the present time, but even this reform cannot be accomplished without opposition from both sides. Many architects would undoubtedly say, if such a change was proposed, "I have no difficulty in finding contractors who are willing to figure my work under the present system. Why, then, should I be put to the trouble and expense of doing unnecessary work?" And the contractor, in his turn, would say, "I see no reason why I should open my books for the architect's inspection and, moreover, it's nobody's business how I arrive at my results."

The simple fact is that in our methods of estimating, as in almost all similar operations, we are led astray from the path of thoroughness and conservatism by the speculative tendencies of our race and time. Instead of conducting our business in accordance with well-defined and recognized principles, we half complete our work, thrust it on the market, and take our chances. This is not the way to accomplish the best results. The American Institute of Architects and the National Association of Builders have conjointly given us the uniform contract, which has settled many of the contested points between architects and contractors, and has prepared the way for further legislation of the same sort, and there is certainly no direction in which the united efforts of these two organizations can better be turned than to reform the present defective methods of estimating.

(*To be continued.*)

BONDING OF BRICKWORK.

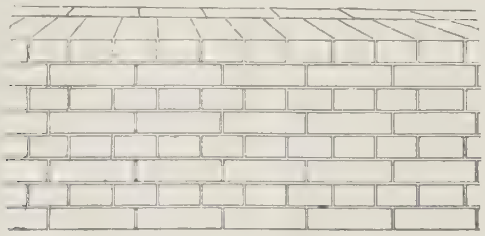
THE Dutch succeeded to the Roman skill in brickmaking and masonry with greater facility than did the English, as their earliest works clearly show. But the method of building walls in Flanders known as Flemish Bond, so pleasing to the eye, is the weakest of all bonds, the most trying and time-consuming to the mason, and the most expensive method of laying brick,— the weakest, because the shortest possible overlap; the most tedious, because of the ever-varying widths and lengths in the American brick, requiring so much culling and clipping. The bond is always running over or falling back; and unless the upright joints in alternate courses are kept on the plumb-line, the pleasing effect is lost. Slovenly workmanship, added to weakness and excessive expense, is inexcusable.



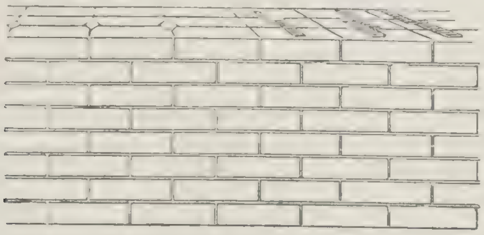
FLEMISH BOND.

Ugliness is a fair apology for strength, utility, and possibly for economy. But the English bond, weak, costly, and ugly, too, has fallen into "innocuous desuetude." The nearest approach to it on this side of the water is that established by law in New York; *one course in five must be headers*, and it is doubtful if a practical mason had anything to say in framing that. It is costly because the mason makes so much better progress laying stretchers; weak, from the excessive number of upright joints.

Since the advent of power press brick in this country for facing walls, the trend of masonry has been to discard all use of headers and present a front with the fewest possible number of upright joints, preserving always the plumb-bond in alternate courses. This has been accomplished by laying an occasional course called a herring-bone, and breaking away the back corners of the face, pushing the corners of the diagonal course nearly to the outside line of the wall; or, by breaking away the back corner of the face brick, as before, and the front corner of the adjoining course and filling the diagonal space with half brick.



ENGLISH BOND.

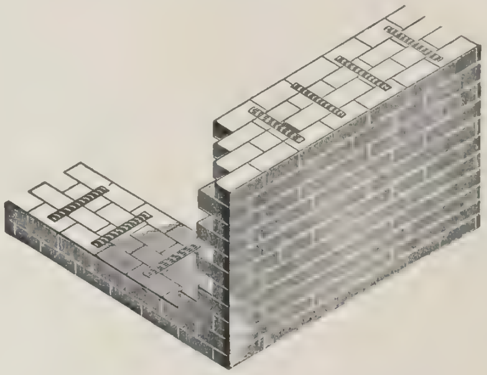


OLD METHOD. NEW METHOD.

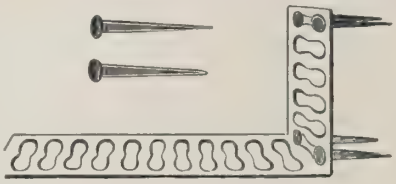
AMERICAN BOND.

Again, facing brick have been bound into the wall with strips of hoop-iron six inches long laid across each brick in the course, eight or nine courses apart; but this, though cheaper and quicker, and without waste of material, may not be the best way. More recently some have used strips of perforated steel, about half the metal being punched away, allowing them readily to fall into the mortar and bed themselves; the brick may be brought down to close joint, and the clinching spaces make this a very firm and satisfactory binder, intelligent, mechanical, and inexpensive.

The same thing has been used for tying new work to old where walls require lining up to increase their strength. The tie is bent near the middle at right angles, and nailed to the old wall with pointed wrought iron nails, made for the purpose, and of sufficient size to hold it firmly in position to receive the new courses which are to enclose it in the lateral joint. Thus avoiding the cutting to pieces and weakening of the old wall, already too weak, to get in a cross header, which at best must hold very imperfectly, after the inevitable shrinkage that comes to all new brickwork.



The crush-resisting strength of a wall is never tested, never questioned. We add course upon course after there is ample strength to carry the burden; these additions are to stiffen the wall, to resist vibrations, to keep it in line. It is held to plumb-line with cross partitions and anchor ties. Why not lay these additional courses, all stretchers with the longest possible overlap bound together with steel ties? Float the brick home in ample machine-rabbed mortar to fill bed and upright joints; lay in the perforated steel ties once in five courses, make the wall a solid mass of selected water-struck brick, bound together with bands of steel, held in place by a rivet of mortar through every clinching space, and you have a 16 in. wall equal to the common 20 in. Whatever lengthens the fiber strengthens the fabric. When land is worth $10 a foot, four inches in width on six stories equals a $20 gain in every running foot of wall, and this, too, with a more elastic and reliable building.



A. MASON.

CEMENT SIDEWALKS.

REPLYING to a correspondent who has had difficulty in making a cement sidewalk retain a smooth surface, a writer in *Paving and Municipal Engineering* says: —

"While the top mixture should be thoroughly rammed or beaten and well troweled, yet this treatment should not be continued so long as to bring to the surface a considerable quantity of neat cement, thus leaving the layer of mortar next below without sufficient cement to bind it together. If this is done, the thin layer of neat cement may flake off when set, revealing a layer of almost clear sand below. A similar result obtains if one attempts to retrowel a surface once finished and partially set but afterwards defaced. Sprinkling the walk before the cement has thoroughly set may cause blisters which mar the appearance of the work; on the other hand, the walk should be protected from the direct rays of the hot sun, or surface cracks may result."

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

EXECUTED IN TERRA-COTTA BY THE AMERICAN TERRA-COTTA AND CERAMIC COMPANY.

CHICAGO. — About one o'clock on the first Monday of each month, Chicago architects may be seen dropping in by ones and twos through the Washington Street entrance of the Institute of Building Arts. This has become a recognized institution, in reality, a large sample room for architects, where every prominent manufacturer of building material or contrivance keeps a specimen of his work on permanent exhibition. The large display rooms, which are under the direct management of the Institute of American Architects, afford good opportunities for the architect to find what he wants and show it to his client. Everything stands ready to be "put through its paces," whether a dumb waiter, a plumbing fixture, or a window screen. A large share of space is given up to displays of fire-proofing, terra-cotta, pressed brick, etc., as well as marble, tile, and interior decoration. In a quiet place at one side a club-room has been reserved, and here once a month the architects gather, with the president of the chapter at the head of the table, and have luncheon and a chat. It is a treat to be present on such an occasion, and after enjoying a good menu, to listen to the discussion of the confident, brilliant young architect, and the quieter opinions of some of the veterans of the profession who have helped build up a great city almost from the days of Fort Dearborn. On the last occasion of this kind, there was present a brick manufacturer who asked the opinions of his hosts on the probable demand for an American enamel brick equal to the English make. This brought forth points on processes of manufacture, influence of the protective tariff, difference between "enamel" and "glaze," prices and possible demands in relation thereto, and so on.

At one of these meetings a gray-haired member answered a question thus: "No, our organization has not done much for the standing of the profession; we have too much jealousy of each other, we are like the medical profession before diplomas were a legal requirement." When will the American Institute number a majority of architects in its membership and do as much for a code of practise (real, not theoretical) as a hod-carriers' union does for its members?

EXECUTED IN TERRA-COTTA BY THE NORTHWESTERN TERRA-COTTA COMPANY.

Speaking of architectural news, although hard times have brought into prominence the ten-cent continuous vaudeville, yet no less than seven schemes for amusement buildings are talked of, and these following the Great Northern Theater and the Coliseum. One of these undertakings is being carried out by architects Hill & Woltersdorf. It is the remodelling of the Casino to make an auditorium to seat seventeen hundred and to be run on the plan of Koster & Bial's, New York. The other schemes have not progressed beyond paper.

Among announcements recently are some fine residences by W. A. Otis and H. V. D. Shaw. Mr. D. Adler is engaged on a seven story shoe factory 92 by 103 ft. in plan of mill construction. He has designed also a building for the Chicago University, comprising a dormitory and gymnasium.

A project which is causing artistic pains and architectural horrors is that of adding three new stories to the County Court Building, a structure which is notorious for its poor arrangement and waste of darkness and money. The indications are that the foundations are already overloaded; but the idea seems to be to remove enough superfluous masonry to allow for a skeleton three-story addition. The County Board has appropriated five hundred dollars, which its architect is to use on preliminary plans. It is to be hoped that the demand for additional space may be met in some other way, until it becomes possible to replace the present structure with a worthy building.

ST. LOUIS. — As the season advances business becomes quieter. In fact, there is no new work of any consequence in contemplation, and there is talk of one or two of the leading architectural firms closing their offices until the revival of business.

Most of the work commenced earlier in the year, and for which arrangements for the money had been made before the silver craze became such a factor, is being finished, but it is impossible to secure money for new enterprises.

Every day furnishes new evidence of the evil results of political disturbances. Factories of all kinds are either reducing their forces, running shorter hours, or shutting down altogether. Only the other day a large factory on the other side of the river closed down, throwing out of employment about one thousand hands. The manufacturers state that owing to the possible disturbance in our financial system their customers are placing only such orders as are required to meet actual demands, and these are not sufficient to warrant their continuing business for the present, at least.

The business interests in a city usually become centralized, and the different districts become known as the retail or wholesale district, etc. This change is rapidly taking place here. Broadway is our great retail street, which also extends west, some on Olive Street. Washington Avenue is fast filling up with wholesale dry goods, shoes, etc., while Cupples Station and vicinity is becoming a wholesale district exclusively, but of a class requiring good shipping facilities, such as hardware, groceries, etc. Second and Third Streets are devoted to the commission houses, while Chestnut is known as Realty Row.

Fourth Street is the Wall Street of St. Louis. Since the State Bank of Missouri moved into the magnificent ten-story structure, erected on the corner of Fourth and Locust Streets, a few years ago, and the Fourth National Bank into the Rialto Building, there have been three other banks located in new quarters on the same street.

Two years ago the National Bank of the Republic built itself a beautiful little home adjoining the Rialto Building. It was only one story, but that seems to be the prevailing fashion for bank buildings. The Mississippi Valley Trust Company has just moved into its magnificent quarters at Fourth and Pine Streets, which is just receiving the finishing touches. It is a stone structure, and although two stories high, the counting room of the bank which faces the two streets extends to the roof. The ceiling is heavily paneled and richly decorated. In the rear of the counting room a stair leads to the balcony, which is used as the work-room for the clerks, etc. The building is of a dignified, classical design, showing much refinement in the detail. Messrs. Eames & Young were the architects, and Mr. Jas. L. Bright the builder. The building on Fourth Street, vacated by the Mississippi Valley Trust Company, is being remodeled by architect E. A. Manny, for the Continental National Bank, and it promises to be equal to any of its neighbors.

TERRA-COTTA DETAIL FOR APARTMENT HOUSE, PHILADELPHIA.
Made by Conkling-Armstrong Terra-Cotta Company.

PITTSBURG. — It is reported that Longfellow, Alden & Harlow are the architects for a magnificent hotel to cost $1,000,000, which will be put up in this city.

Architects Peabody & Stearns, who have opened an office here, are preparing plans for a colonial residence for Ed. H. Binn, to cost $25,000.

The congregation of Trinity Protestant Episcopal Church, of Braddock, has decided to erect a new edifice, to cost $20,000.

Architect E. B. Milligan is preparing plans for a brick and stone church for the East End Presbyterian congregation, corner of Peoples and South Avenues, to cost about $12,000.

Architect J. E. Allison has been commissioned to prepare plans for a brick and stone church for the First Presbyterian Congregation of Vandegrift, to cost about $16,000.

Architect J. L. Beatty is preparing plans for a brick church to be erected at Indiana, Penn.; the same architect has prepared plans for an office building and apartment house for the Allegheny Heating Company on West Diamond Street.

Architects McKee & Waughter are preparing plans for a twelve-room schoolhouse for the thirteenth ward, to cost nearly $30,000.

Architect Edward Stotz is preparing plans for a large two-story brick schoolhouse, which will be erected at Hazelwood.

Architect T. E. Cornelius is preparing plans for a public school to be erected at Coraopolis, two stories high, of brick and stone.

Architects Bartberger & East have prepared plans for a three-story brick hotel for Daniel Cusack, to be erected at Shanopin; also a three-story brick hotel for Charles Stokey, to be erected at Zelienople.

PART OF TERRA-COTTA MANTEL.
Made for residence of George M. Hutton, Esq., Newport, R. I., by the Perth Amboy Terra-Cotta Company. Peabody & Stearns, Architects.

Architect Joseph Stillberg is preparing plans for a four-story brick hotel for John Thier, to be erected at Braddock.

Architect J. F. Steen has prepared plans for a handsome brick colonial residence for W. H. Berger, on Linden Avenue, near Penn.

Architect Charles W. Bier is preparing plans for a three-story building for the Sisters of St. John's Roman Catholic Church, to be erected in Bloomfield.

Architects Shaw & Metcalf are preparing plans for a twelve-room colonial brick residence, to be erected in Bellevue.

Architects Boyd & Long are preparing plans for a colonial brick residence of twelve rooms, on Elliott Street.

Architect T. C. McKee is preparing plans for three $15,000 red pressed brick colonial dwellings in the East End.

BUFFALO. — The political firmament, with its gold and silver myth, has produced evil results upon building operations here.

Bright gleams of hope filled the minds of some private individuals, promoters, etc., who were contemplating buildings of importance, but the banks and capitalists raised a serious cry of "Wait for the St. Louis Convention and its platform."

The advance agent of prosperity restored their confidence but momentarily, for at Chicago came the climax, and the hopes that were smoldering in the breast were hushed to rest within that grave of uncertainty — I say "grave of uncertainty," for the general impression is stagnation in building until after election, and the probable outcome is still a greater question.

The disaster caused by part of the old Brown Building collapsing while undergoing repairs, in which several lives were lost, disclosed, under a strict investigation by the district attorney, that an architect had not been retained upon the building, while a defective column and its improper base produced the sad affair.

While examination showed the superintendent of buildings and his assistant somewhat careless, no blame could be placed upon this department; the verdict showed gross neglect on the part of the dead mason contractor, and convicted the living sub-contractor.

The tendency will, no doubt, end in raising the architectural standard here, and produce a marvelous effect upon the building superintendent in having plans properly investigated and rattle-traps inspected, as it has aroused universal indignation.

Among buildings in process of construction may be noted: —

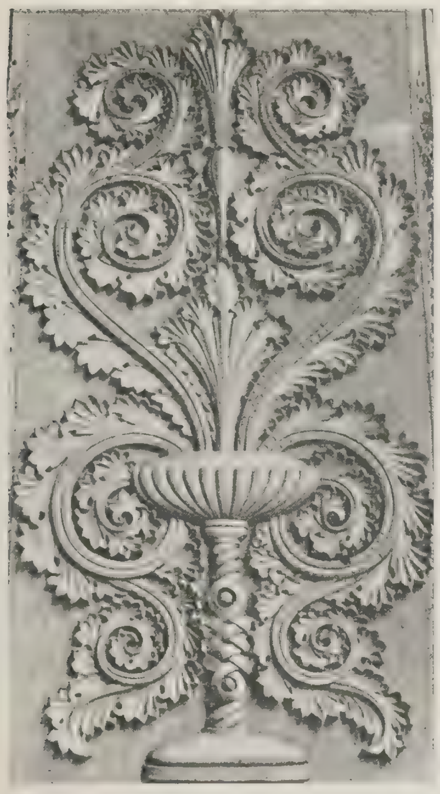
St. Paul's Guild House, Pearl and Erie Streets, $40,000, Green & Wicks, architects.

Brick block, corner Connecticut and Normal Avenue, $50,000, Charles E. Swan, architect.

Colonial apartments, Delaware Avenue, five stories high, red brick with marble trimming, cost, $50,000, Boughton & Johnson, architects.

Three-story brick and terra-cotta flat for A. V. Roys, $20,000, Phillips & Pentecost, architects.

Larkin Soap Company, Seneca and Heacock Streets, six-story brick factory and warehouse, 66 ft. by 150 ft., cost, $50,000.



TERRA-COTTA PANEL.
Executed by the New Jersey Terra-Cotta Company.

Residence for W. H. Glenny, Ferry Street and Delaware Avenue, cost, $30,000, Green & Wicks architects.

Residence for Charles H. Williams, corner North and Delaware Avenue, cost, $60,000, brick with marble trimmings, McKim, Mead & White, architects, New York.

MINNEAPOLIS.—Building operations continue here on same scale as at last reports. We do not look for any material improvement before next spring, capital being generally disposed to wait developments in November before making any further venture of any magnitude. There have been enough large enterprises temporarily laid aside to insure a brisk season next year, provided a mistake is not made at the election next fall.

Architect W. B. Durrell has planned a three-story fire-proof building for W. H. Eustis, at Third Avenue, South and 5th Streets, 71 by 100 ft.; press brick and brownstone; cost, $50,000.

The contract for new brick school building at Lamberton, Minn., was let to Erick Lund, of Minneapolis, at $14,039, using common brick. Orff & Joraleman, architects.

H. W. Jones has planned two new schoolhouses for Richfield, Minn., 40 by 80 ft., two story; one of pressed brick, to cost $8,000, the other of common brick, to cost about $5,000. Contracts let August 8.

On Friday, July 17, a number of architects and contractors visited the plant of the Northwestern Brick & Fire-proofing Company, at 38th Avenue and Marshall Street, to inspect the clay deposit and plant and to witness the test of several terra-cotta arches. They found over forty acres of clay of fine quality, 50 ft. deep, apparently inexhaustible. They inspected several arches which had been laid up for actual service, and a committee of architects was selected to conduct the test. They selected a 6 in. segment of 12 ft. span, which had stood for eighteen days with a load of 550 lbs. to square foot, for a special test. This arch was loaded up to 1,020 lbs. per square foot, without any signs of weakening whatever, which makes a remarkably good record for the hollow terra-cotta in question.

ST. PAUL.—Contracts were recently let to Butler-Ryan Company, of St. Paul, for new office building for Northern Pacific Railway Company, to be L shaped, 116 ft. on Broadway, 62 ft. deep, and running back 120 ft. from corner. To be five stories and basement; two lower stories of granite, balance mottled brick, pressed and ornamental and terra-cotta. There will be a one-story detached engine house 80 by 37 ft., of pressed brick. To be iron and steel construction, fire-proof, and cost about $180,000. Cass Gilbert, architect.

Plans have been ordered for a new four-room schoolhouse on Wayzata and Albemarle Streets, to cost $12,000.

Buechner & Jacobsen have been selected as architects for Catholic Theological Seminary at Dubuque, Iowa, to cost $100,000.

ROCHESTER.—The same old tale of woe that has been ground out for the last few months can only be repeated—there is very little going on.

The Building Committee of St. Paul's Protestant Episcopal Church have let contracts to A. Friedrich & Sons and T. W. Finncane for the erection of their new edifice. Building will be of Buff Amherst stone, and will cost, including parish house, $150,000. Parish house will be partly of pressed brick. Heins & LaFarge, of New York, are architects.

Architect Geo. F. Hutchison has let contracts to Kneale & Stuart for the erection of a four-story manufacturing building, to be built on Court Street, for Sargent & Greenleaf.

Same architect has prepared plans for a two-story store and office building to be built at Caledonia. Press brick, furnished by the New York Hydraulic Press Brick Company.

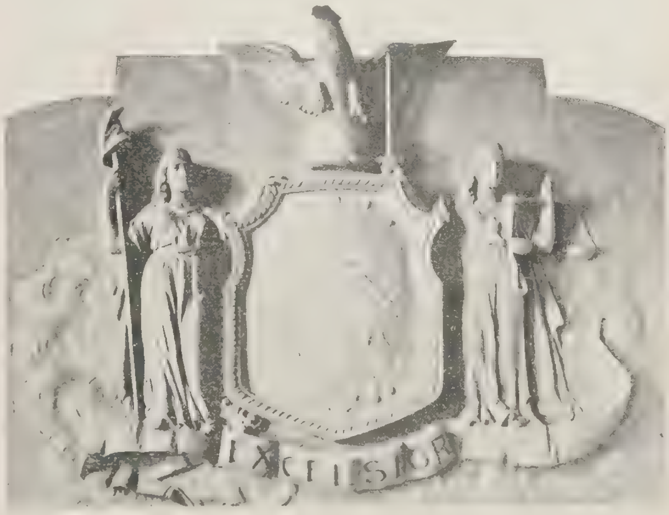
Also $15,000 house to be built at Lancaster, press brick furnished by same company.

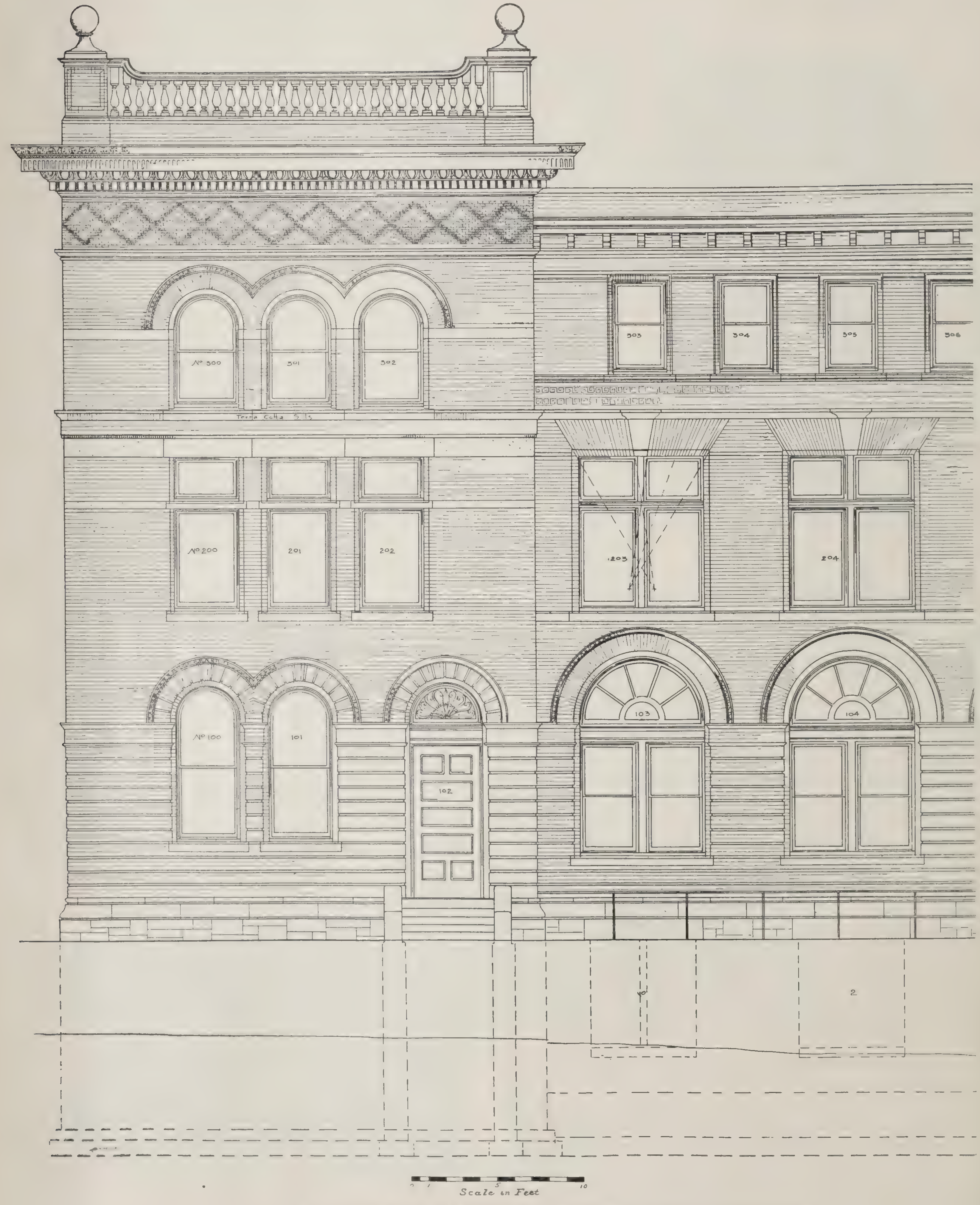
Chas. F. Crandall, architect, has let contracts to W. H. Gorsline for the erection of a two-story morgue for Jeffreys & Co., to be built on East Avenue. Building will be of brown rock-faced press brick and terra-cotta, furnished by the New York Hydraulic Press Brick Company.

Same architect has also prepared plans for an addition to Webster Union School, cost, $10,000.

NEW VETERINARY COLLEGE BUILDING, CORNELL UNIVERSITY.

THE new veterinary college building recently completed for Cornell University is a structure of yellow brick and terra-cotta 140 ft. long with a depth of about 200 ft. It is one of six buildings which the State is to provide for the various departments of veterinary science. The building in design presents a straight front in three stories, with slightly projecting pavilions at each end, and a central portico crowned above the third story by a low dome. We publish on page 156 a drawing showing one of the end pavilions of the front of the building, and below we reproduce the arms of the State of New York, which crown the central portion of the building. This work was modeled by Mr. Louis Roncoli, of the New York Architectural Terra-cotta Company, from a small engraving which was supplied by the Secretary of State. This building has been erected from the designs of Professors Osborne and Martin, of the Architectural Department of the University.





END PAVILION OF THE NEW VETERINARY COLLEGE, CORNELL UNIVERSITY.

BO. [illegible]

AN INTERESTING STUDY IN THE DISINTEGRATION OF BRICKS.

WE publish below three illustrations showing climatic effects on brick walls that were built of very poor and porous bricks, such as are found among the common bricks made in many parts of the country, and which become quickly saturated with water during storms which, freezing and thawing with the changes of temperature, crack and chip the surface of the brick to an extent hardly appreciated by those familiar only with our more dense and compact bricks.

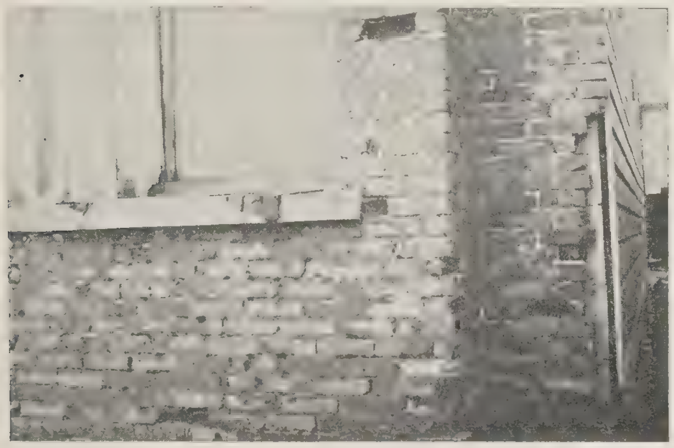


FIG. 1.

FIG. 2.

That it is possible to preserve the surface of such a wall would seem to be demonstrated by the results shown in the accompanying illustrations.

FIG. 3.

Figure 1 shows the cracked and chipped condition of a wall at the northeast corner of a house on Howe Street, Vancouver, built four years ago.

Figure 2 shows the condition of a wall at the northeast corner of a house on Granville Street, Vancouver, which had been covered with tar eighteen months.

Figure 3 shows the condition of the wall at the northeast corner of the Metropolitan Club Building at Vancouver, which was covered four years ago with Cabot's Brick Preservative.

WITH THE BUSY.

Waldo Bros. will furnish Hoffman and Portland cement for two sections of the Metropolitan Water Works at Northboro, Mass.

Waldo Bros. will furnish the architectural terra-cotta on the following contracts: Pope Building, Columbus Avenue, Boston, Peabody & Stearns, architects; J. W. Bishop & Co., contractors. Bank Building, Newton, Mass., W. G. Preston, architect; H. F. Ross & Co., contractors.

The New Jersey Terra-Cotta Company is now working on the terra-cotta for four residences in West 77th Street, of which C. P. H. Gilbert is the architect and Harvey Murdock the builder.

This company has received the contract for supplying the terra-cotta work for Phœnix Mutual Life Insurance Building at Hartford, Conn., Cady, Berg & See, architects; office building, 708 Broadway, New York, Cleverdon & Putzel, architects; Polish Catholic Church, Brooklyn, Angell & Higginson, architects.

The Pennsylvania Enameled Brick Company has just completed the interior lining of enamel brick approach to Brooklyn Bridge, New York City side, and are now delivering a large quantity of about 50,000 enameled brick for the lining of interior of stable for Commodore Gerry, 62d Street and Madison Avenue, New York City; architect, Alfred Zucker, New York City.

They have also just completed a large order for enameled brick to be used in the Pennsylvania Hospital, corner 8th and Spruce Streets, Philadelphia, Penn.

The New York Architectural Terra-Cotta Company has secured the following important contracts, and are now engaged upon the work:—

The Central Syndicate Building, corner of Broadway and Pearl Street, New York, Mr. John T. Williams, architect.

The Hamilton Club Building, Paterson, N. J., Mr. Chas. Edwards, architect.

Five residences on the upper west side, New York, Messrs. Thom & Wilson, architects.

The Pavilion Building, Tremont Street and Pemberton Square, Boston, Messrs. Burr & Sise, architects, Boston.

The White Brick and Terra-Cotta Company, New York, has just completed the terra-cotta for residence 718 Fifth Avenue, architects, Jardine, Kent & Jardine; six residences on East 82d Street, New York, architect, Mortimer P. Thain; and have, during the last month, closed the following contracts: four apartment houses, 124th Street, near Eighth Avenue, architects, Thom & Wilson; store and lofts, 51 West 3d Street, New York, architect, Louis Korn; Bank at Flushing, L. I., architects, W. J. Wallace and S. E. Gage; Coe Building, 636–638 Broadway, New York, architect, George B. Post; St. Paul's Church and Parish House at Rochester, N. Y., architects, Heins & LaFarge; store building, 78 Fifth Avenue, New York, architect, Albert Wagner; and store and lofts, 84–90 Van Dam Street, New York, architects, De Lemos & Cordes.

The Perth-Amboy Terra-Cotta Company will furnish the architectural terra-cotta on the following contracts:—

New York Athletic Club, southeast corner 59th Street and Sixth Avenue, New York City, W. A. Cable, architect.

Building for Joseph P. Smith, Baltimore, Md., Joseph Evans Sperry, architect.

Residence for Louis Dreyer, Paterson, N. J., C. J. Post, architect.

Dwelling for D. C. Phillips, Washington, D. C., Hornblower & Marshall, architects.

Warehouse, 49 West 13th Street, New York City, Clinton & Russell, architects.

Building for Arbuckle Bros., Water Street and Old Slip, New York City, Frank Freeman, architect.

Engine house, No. 20, Baltimore, Md., Geo. C. Haskell, architect.

Dormitory for Catholic University, Washington, D. C., L. Norris, architect.

Office building for Queen's Insurance Company of America, northeast corner William and Cedar Streets, New York City, Harding & Gooch, architects.

Coatesville School, Coatesville, Penn., A. W. Dilks, architect.

Lindner Building, Clifton Springs, N. Y., J. Mills Platt, architect.

Church, Fitchburg, Mass., H. M. Francis, architect.

Library, Newbury, Vt., H. M. Francis, architect.

Stephen Cooper & Co., Philadelphia, manufacturers of artificial marble and workers in clay, ornamental plaster, and metals, report a thriving business, and judging from the following list of contracts, which they report having supplied or are supplying, it is evident that they have not felt the existing depression in business to any extent.

ORNAMENTAL PLASTER WORK AND MODELING.

Building.	Architect.
Broad Street Station, Philadelphia,	Furness, Evans & Co.
Steamship " St. Louis,"	" " "
" " St. Paul."	" " "
Ferry-boat " New Jersey,"	" " "
" " Camden,"	" " "
" " Pittsburg,"	" " "
Residence for A. J. Cassatt, V. P. Penn. R. R. Co.,	Furness, Evans & Co.
Merion Cricket Club House, Haverford, Penn.,	" " "
Reading Terminal, Philadelphia,	Wilson Bros. & Co.
Residence for J. H. Converse, Rosemont, Penn.,	" " "
University of Vermont, Burlington, Vt.,	" " "
Horticultural Hall, Philadelphia,	F. M. Day & Bro.
Church, 17th and Spruce Streets, Philadelphia,	" "
Residence for Potts estate, Wyebrook, Penn.,	T. P. Chandler.
Bank of Pittsburg, Pittsburg, Penn.,	Geo. B. Post.
Prudential Insurance Company Building, Newark, N. J.,	" "
Residence for Daniel Baugh, President Art Club, Philadelphia,	Hazlehurst & Huckle.
Art Club, Philadelphia,	F. M. Day & Bro.
Siegel, Cooper & Co. Building, New York City,	De Lemos & Cordes.

NATURAL AND ARTIFICIAL MARBLE.

Hotel Bellevue, Philadelphia,	John T. Windrim.
Real Estate Building, Buffalo, N. Y.,	Green & Wicks.
Siegel, Cooper & Co. Building, New York City,	De Lemos & Cordes.
Flats, 58th Street and 6th Avenue, New York City,	Horgan & Slattery.
St. James Hall, Philadelphia,	Rankins and Kellogg.
Mercantile Club, Philadelphia,	Baker & Dallett.
Residence for H. S. Jeanes, Philadelphia,	Robert Stulb.
N. Y. C. & H. R. R. R. Co. Station, Syracuse, N. Y.,	B. L. Gilbert.
Jefferson County Bank, Watertown, N. Y.,	J. W. Griffin.
Hotel Jefferson, Richmond, Va.,	Carrere & Hastings.

TREASURY DEPARTMENT, Office Supervising Architect, Washington, D. C., August 5, 1896. SEALED PROPOSALS will be received at this office until 2 o'clock P. M. on the tenth day of September, 1896, and opened immediately thereafter, for all the labor and materials required for the stone and brick masonry, terra-cotta work, iron work, roof covering, skylight, etc., for the superstructure of the United States Post-Office Building at Buffalo, N. Y., in accordance with drawings and specifications, copies of which may be had at this office or at the office of the superintendent at Buffalo, N. Y. Each bid must be accompanied by a certified check for a sum not less than two per cent. of the amount of the proposal. The right is reserved to reject any or all bids, and to waive any defect or informality in any bid should it be deemed in the interest of the Government to do so. All bids received after the time stated will be enclosed in envelopes, sealed, and marked, "Proposal for the Superstructure and Roof Covering of the United States Post-Office, Buffalo, N. Y.," and addressed to WM. MARTIN AIKEN, Supervising Architect.

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Representation of a FIREPLACE MANTEL. Our Sketch Book, containing 39 others, will be sent you on application.

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In such Colors as Red, Cream, Buff, Pink, Brown, and Gray. These Mantels cost no more than other kinds, but are far better. They are easily set, and have a richness and simplicity of effect which is decidedly pleasing.

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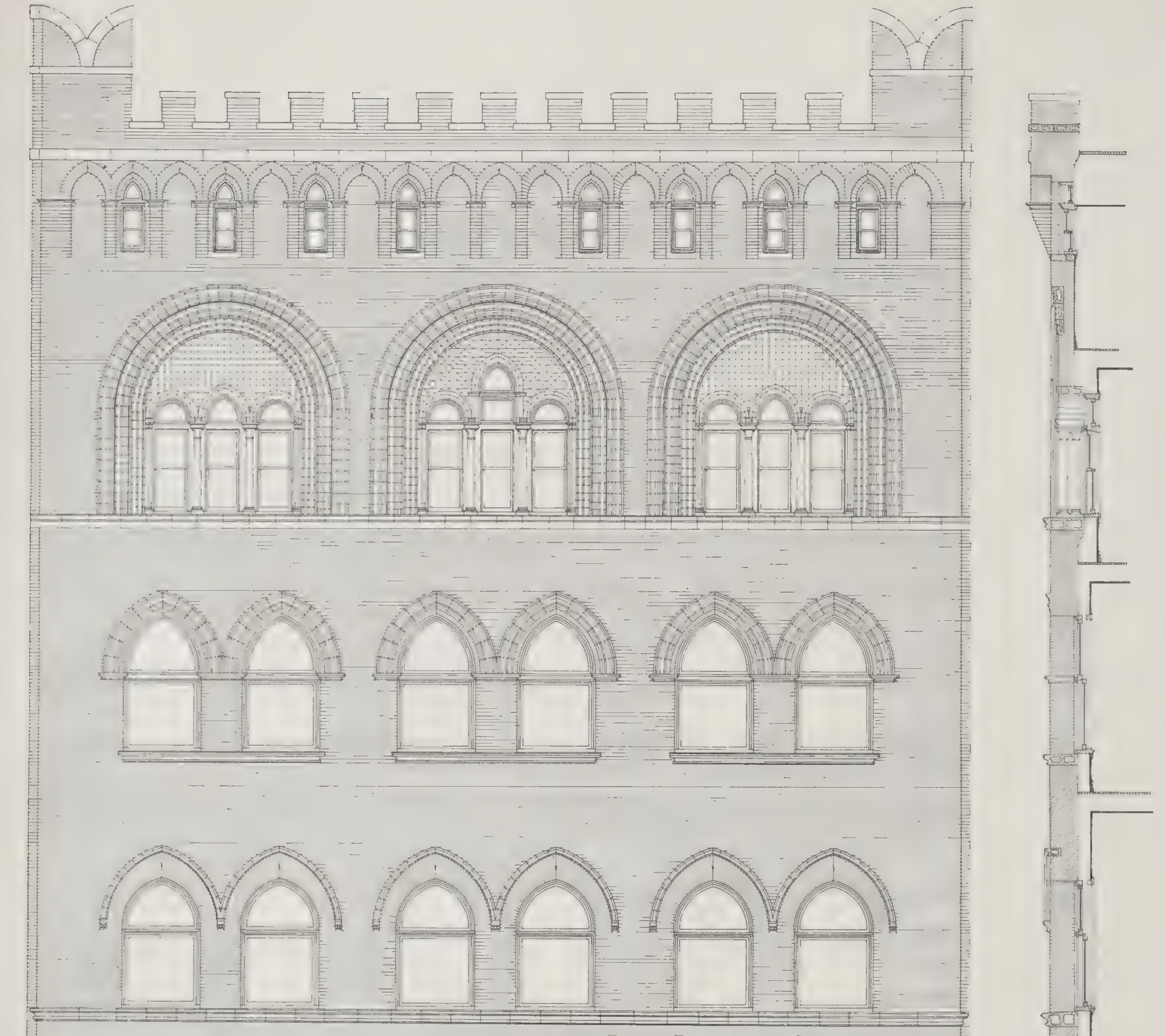

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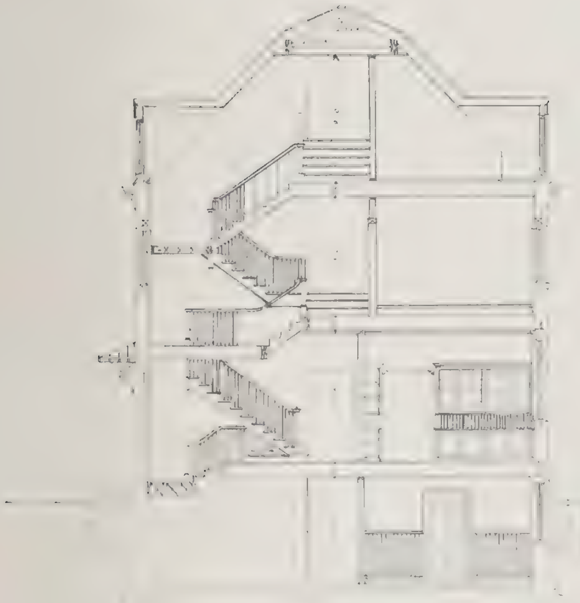
FRONT ELEVATION OF THE BAKER BUILDING,

1521 and 1523 Sansom Street, Philadelphia.

FRANK MILES DAY & BROTHER, ARCHITECTS.

THE BRICKBUILDER.

VOL. 5. NO. 8. PLATE 44.



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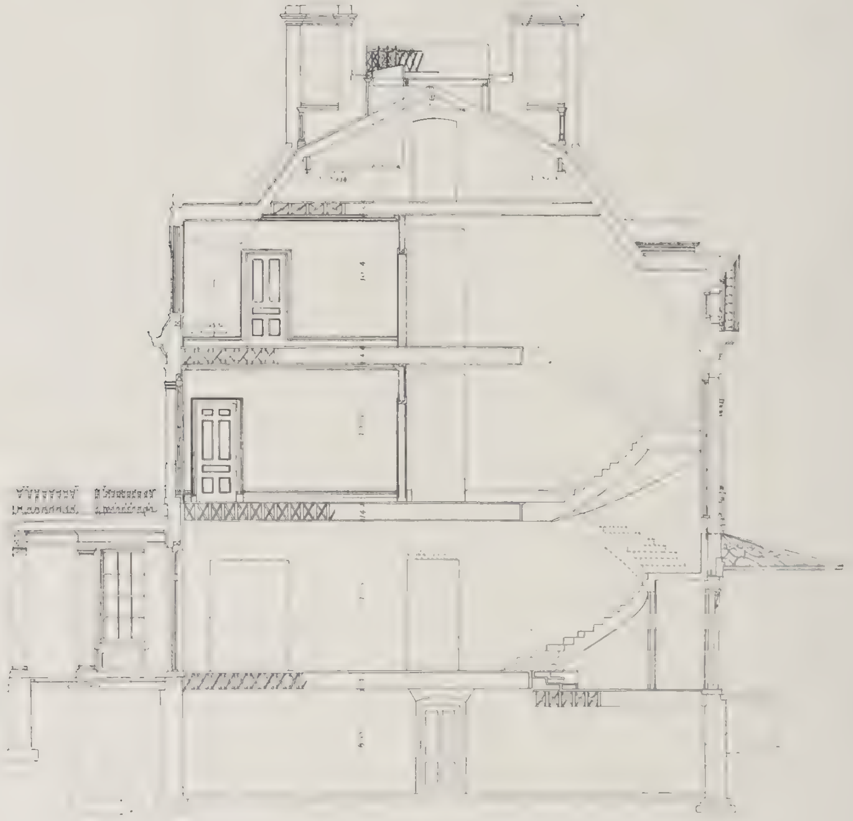
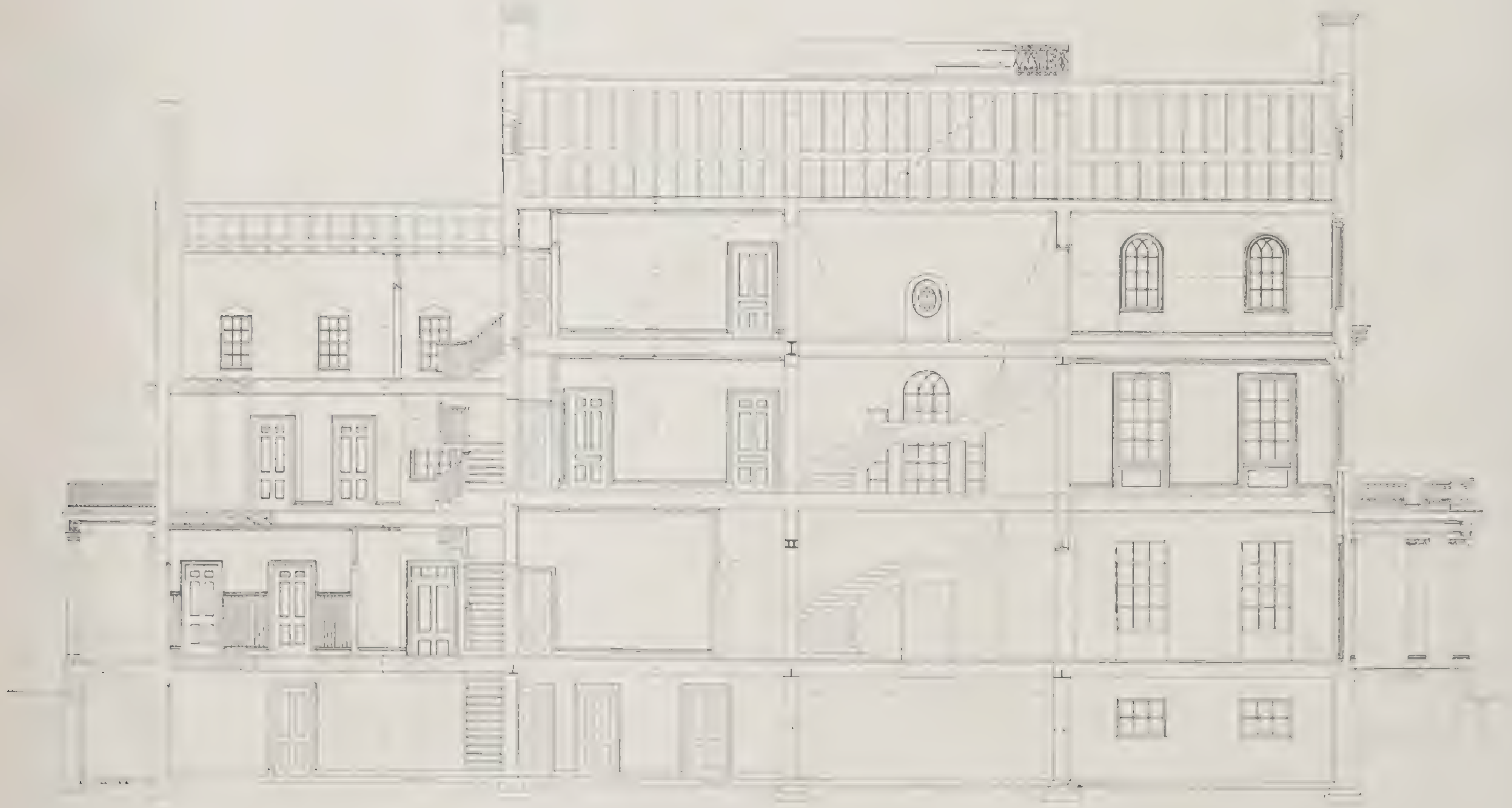


CROSS SECTION THROUGH CENTRE OF MAIN HALL



LONGITUDINAL SECTION

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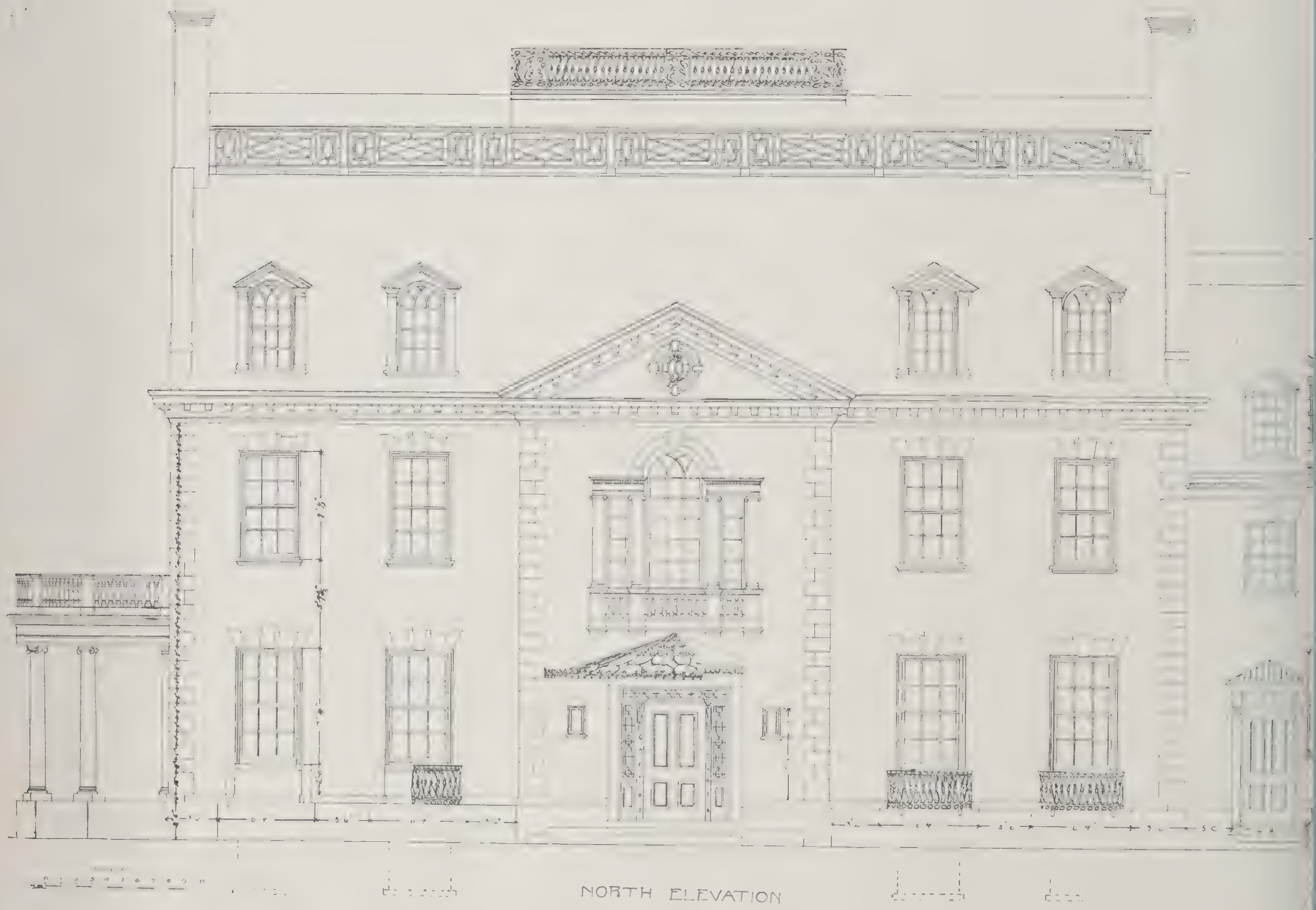
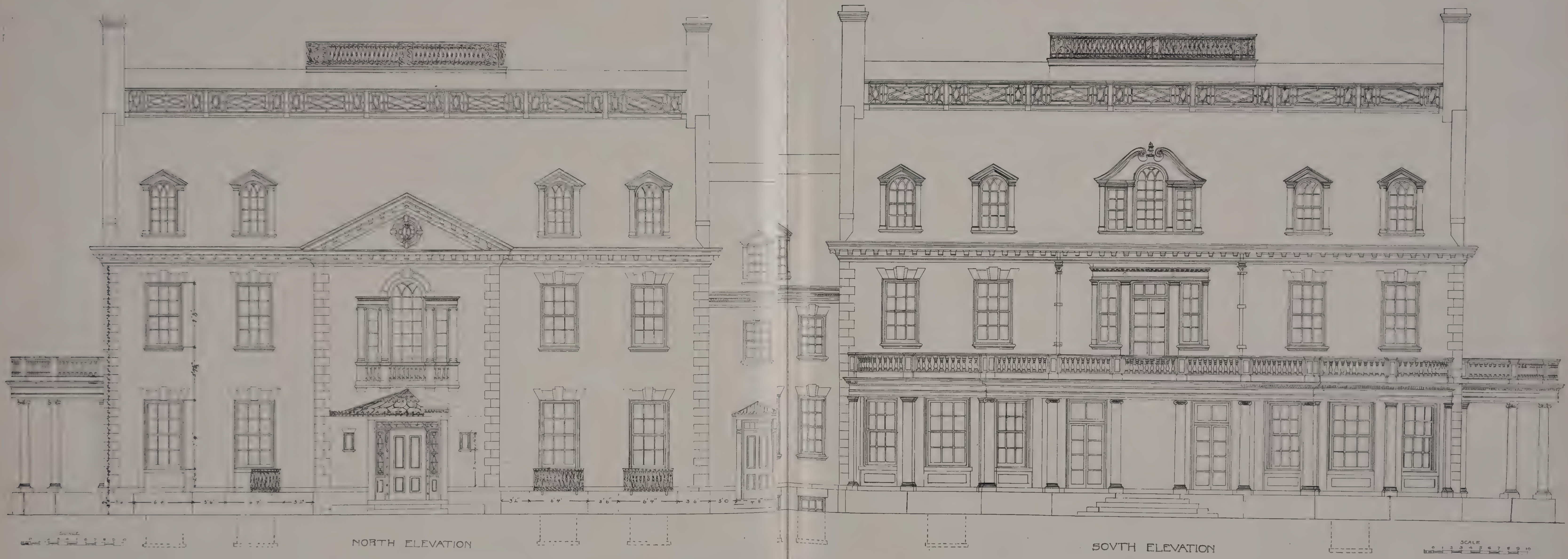
McKIM, MEAD & WHITE, ARCHITECTS.



NORTH ELEVATION

BRICK RESIDENCE FOR R. K
McKIM, MEAD &



NORTH ELEVATION

SOUTH ELEVATION

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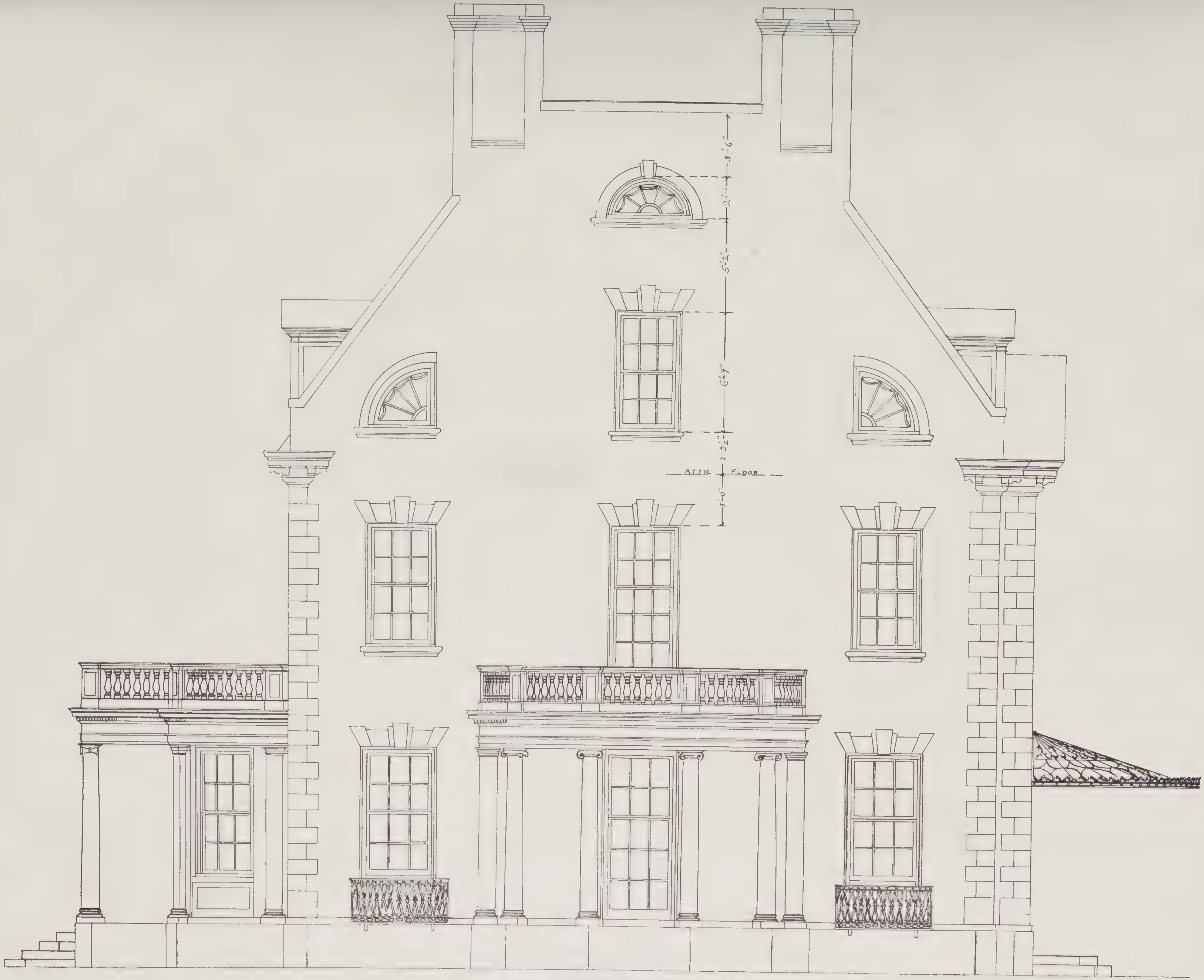
McKIM, MEAD & WHITE, Architects.



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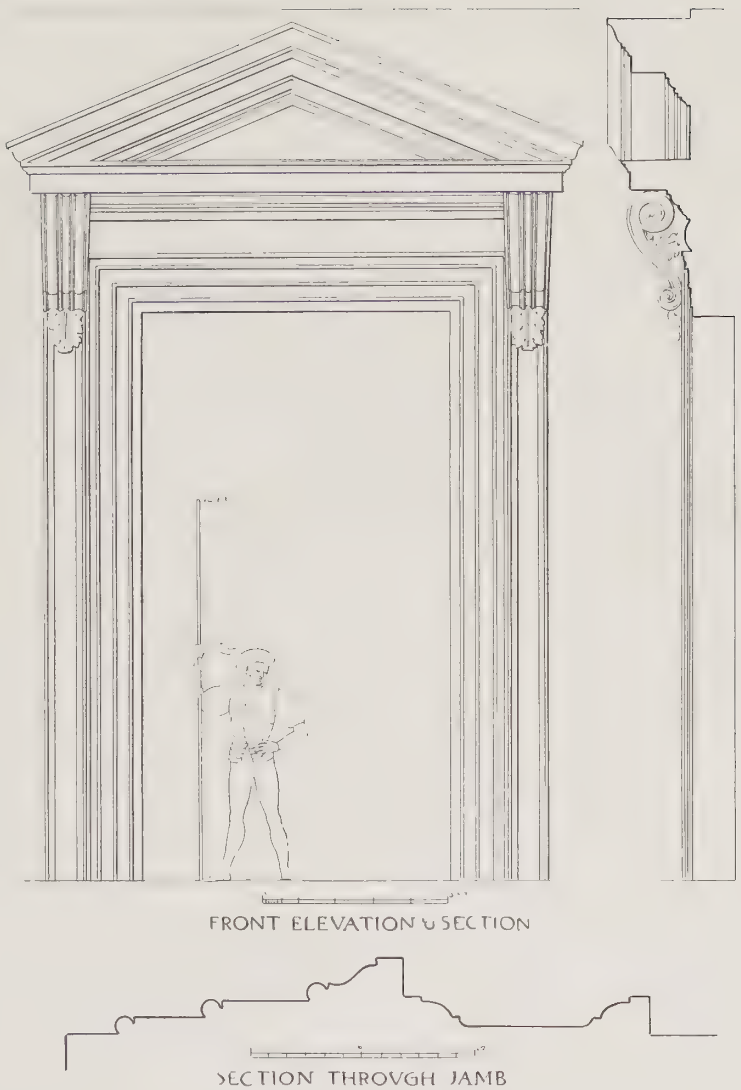
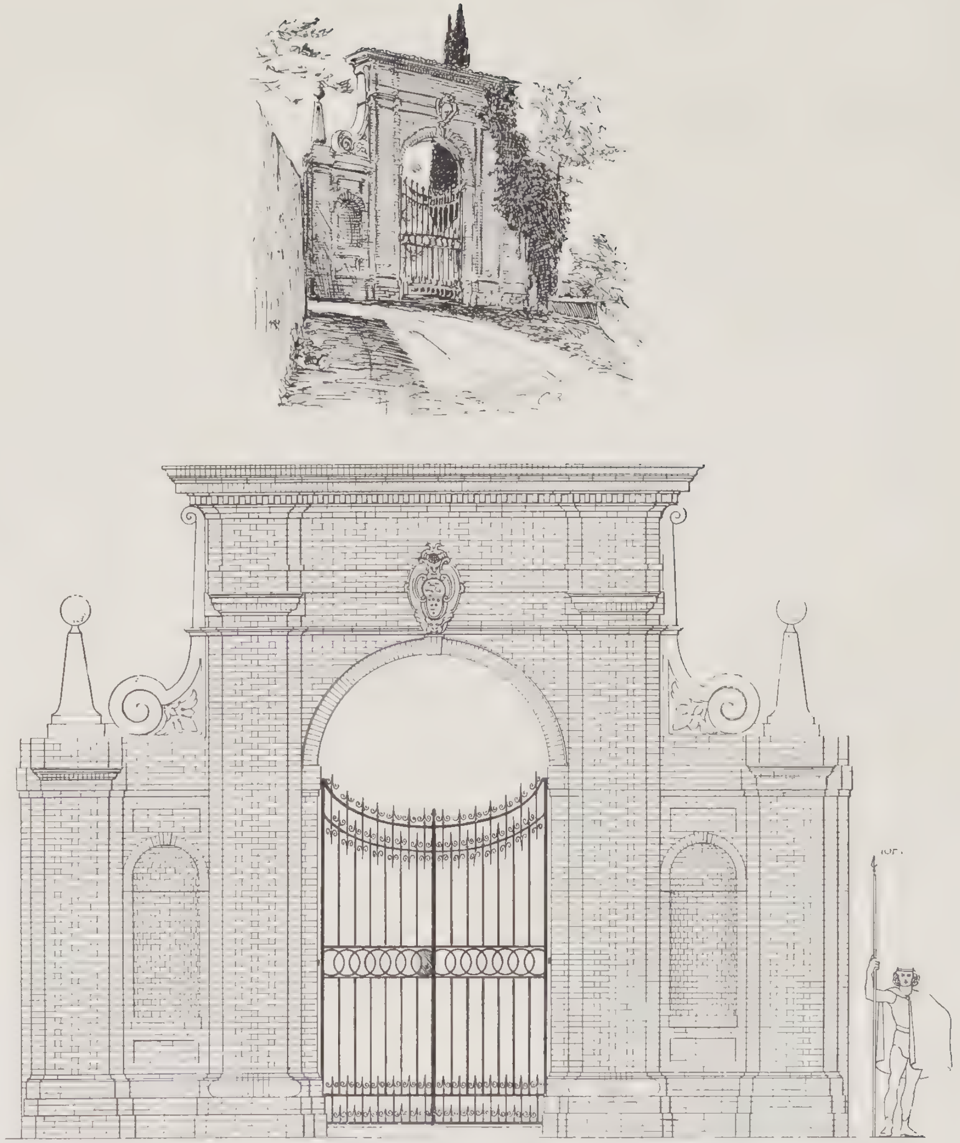
EAST ELEVATION.

BRICK RESIDENCE FOR R. K. ROOT, ESQ., BUFFALO, N. Y.

McKIM, MEAD & WHITE, ARCHITECTS.



GARDEN ENTRANCE TO THE VILLA MADAMA ROME



BOSTON PUBLIC LIBRARY.

A BRICK GATEWAY NEAR SIENNA, ON THE ROAD TO CALLE.

MEASURED AND DRAWN BY CLAUDE F. BRAGDON.

VOLVME
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1896
No. 9

THE BRICKBVILDER

OFFICE
85
WATER
STREET
BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

Cushing Building, 85 Water Street, Boston.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

The Brickbuilder is published the 20th of each month.

IMITATION IN BUILDING MATERIALS.

THE essential characteristic distinction between a design which is to be executed in terra-cotta and one which is to be executed in stone is not always easily maintained. The distinction, however, is a vital one and is thoroughly appreciated by an educated architect. The illustrations which we have published in connection with Mr. Marquand's articles on the Della Robbia work are good examples in point. No one looking at these shrines or frames would ever think of them as being constructed in any material but terra-cotta. Although the moldings are manifestly similar to those which are used in other materials, and the motives of decoration are precisely the same in some cases, yet when it comes to the touch, to the spirit of the design, we know at once that it was intended to be wrought in terra-cotta and in nothing else. There is every evidence that the artist-craftsmen and architects of the early Italian Renaissance period were keenly sensitive to fitness of material for its intended use, but the distinction is too often forgotten in modern work. The architecture of to-day is so largely retrospective and borrows so lavishly from every preceding epoch, that with the abundance of good photographs illustrating all of the great works of the past, it is no wonder the architect sometimes loses sight of the niceties which should be observed in their correlation to the material employed; and the use of the burnt clay products for the best class of work being in a certain sense a relatively modern revival, terra-cotta is sometimes characterized as being only an imitation in a cheaper material of the forms which are derived from stone architecture.

In one sense all the architecture of the present period is imitative. There are certain general forms, motives, moldings, and details which appertain to architecture in the broader sense, irrespective of material, being within vaguely defined but perfectly appreciated limits eminently proper for execution in terra-cotta, stone, iron, wood or plaster; and being applied in one medium does not imply copying from another. Indeed, the charge might very easily be turned the other way and the statement made that stone work is very often imitated from terra-cotta designs. What architect has not sometimes longed to copy in stone the delicate terra-cotta work of such buildings as the Certosa Monastery at Pavia, work which is essentially and fundamentally nothing but terra-cotta in its character? We have seen even some of the Della Robbia shrines copied line for line in wood, which is a more unjustified translation than if they were to be carved in stone. The spirit of imitation is so inground in our architectural traditions that it is small wonder we sometimes fail to observe the fitness of form in its relation to material; and yet, on the whole, we are inclined to believe that there is less of this false simulation in terra-cotta work than in any other material. It is comparatively rare to find a terra-cotta building which gives one the impression of being constructed in stone. The necessary difference in the jointings, the facilities with which some contours and shapes can be executed in the plastic material, and the fact that others have to be avoided entirely of necessity make it really difficult to strictly imitate a stone effect in brick and terra-cotta; and notwithstanding the charge which can, we admit, with certain justice, be charged against some of the work, we believe that, on the whole, the burnt clay arts are on a properly recognized artistic basis, and the tendency is every year more and more to emphasize the particular expression, and to make more manifest the actual fitness of the material to the design.

Just in what consists this fitness it is almost impossible to exactly define. It is a matter of sentiment and feeling rather than of concrete form. If any one doubts this, let him try the very simple experiment of deliberately executing a molding or piece of carving first in stone and then in terra-cotta. Even when the attempt is made to produce an identical effect, the result will be nearly always entirely different. To borrow our motives, and in a general way our sense of detail, from stone, wood, or what not, is perfectly legitimate so long as we give the result the character of the chosen material; and the thoughtful designer who appreciates the possibilities as well as the limitations of terra-cotta, and will stand over his work in the modeling as well as on the drawing table, has not the slightest difficulty in making terra-cotta manifestly true to itself.

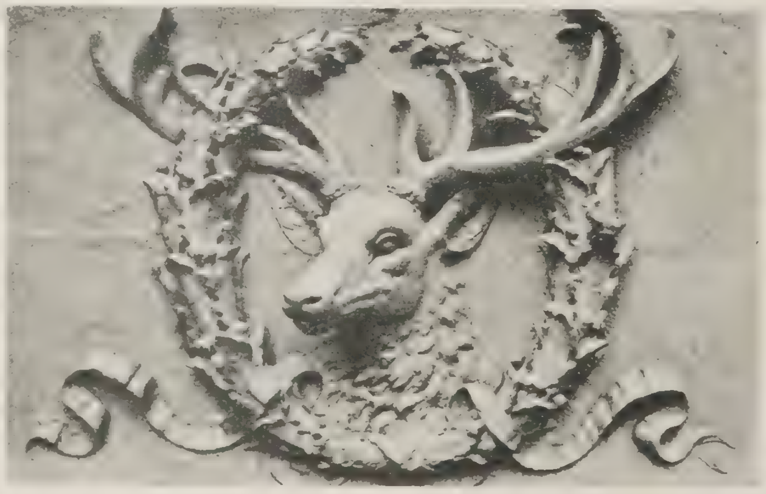
It has been said that the newer shades of brick and terra-cotta have been designed by our manufacturers and adopted by our architects with a view to reproducing as closely as possible the effect of a stone building without being obliged to pay the cost. This we deny entirely. We do not believe that the element of cost alone has ever determined the selection of face brick instead of stone when the choice has rested with a thoroughly trained architect. Good brick and terra-cotta need no such plea for their existence, and the fact that we have a hundred or more shades of terra-cotta and brick at command where formerly there were but two or three, and that this variety will enable us to give a tone to our buildings which is similar to the tone given by some kinds of stone, simply enlarges the resources at the architect's command, but does not in any sense imply that the sole object in using colored brick or terra-cotta is to simulate the effect of a particular stone. To a certain extent color can almost be said to be independent of the material, and if a deep neutral tint is required to produce a certain effect on a building, it by no means follows that we should feel obliged to use stone for that purpose simply because the corresponding tone in brick is an artificial product, and resembles what nature has done with stone. We are afraid of color, we use it timidly, and when we dare to use even colored stone, we do it with a sort of reluctant apology that nature made the color, and therefore it must be all right. But nature has given us also the means of coloring our brick and terra-cotta, and producing shades which are entirely beyond the reach of any stone quarry, and it is not imitation to the slightest extent when we can improve upon the crude raw material of nature. We are not saying that the burnt clay products are necessarily superior to stone for building material. Each has its place, and there is room in the world enough for all, but the burnt clay products have the advantage of plasticity, the wider range of color, and greater ease of manipulation, and the imitation of stone effects which has been urged as a defect in some of our recent terra-cotta work springs from incidental effects rather than from any deliberate intent.

THE special prizes offered in The Barta Press Competition have been awarded by Mr. Barta to the following contestants : —

Wm. E. Restieaux,	Columbus. Ohio.
Wm. P. Bausmith,	Cincinnati. Ohio.
Joseph Wig, Jr.,	Chicago, Ill.
Paul G. Hentz,	Dayton, Ohio.
Elmer Grey,	Milwaukee. Wis.
Henry M. Stillman,	Milwaukee, Wis.
Wm. Leslie Welton.	Boston. Mass.
Ernest A. Van Vleck,	Ithaca, N. Y.
Peter Brust,	St. Francis, Wis.
F. S. Swales,	Rochester, N. Y.
Eddy Fairchild, Jr.,	Dayton, Ohio.
James C. Green,	West Orange, N. J.
L. Eugene Jallade,	New York City.
Gilbert F. Crump,	Rochester, N. Y.
Chas. G. Bachmann,	Allentown, Penn.
O. J. Danernhein,	St. Louis, Mo.
J. P. Daly,	Boston, Mass.

ILLUSTRATED ADVERTISEMENTS.

HARTFORD is preeminent as the headquarters of insurance institutions, and the business connected with them has long been regarded as the staple industry of the city. The Hartford Fire Insurance Company are just now adding an extra story to their premises, and extending it along Trumbull Street. The present building is a massive granite structure, but the new portions are being done in terra-cotta, which has been made a very close match for the granite, not only in color, but in surface texture. The hart, or red deer, is associated with the arms of the city, and the head has been worked into the ornament on panels in the new extension. Cady, Berg & See are the architects, and the terra-cotta is being supplied by the New York Architectural Terra-Cotta Company.



IN the advertisement of Charles T. Harris, lessee of the Celadon Terra-Cotta Company, page xxvi, is illustrated a bungalow at Monument Beach, Mass. George H. Gardner, Esq., owner. Willard T. Sears, Boston, architect.

SOCIETY AND PERSONAL NOTES.

MR. CHARLES F. SCHWEINFURTH, architect, has removed to the New England Building, 129 Euclid Avenue, Cleveland.

MR. WILLIAM H. ABBOTT, JR., whose office is at 19 Broadway, New York City, is at present making a tour of England sketching and studying the old English style of architecture.

ON Monday evening, September 21, the Chicago Architectural Club held its first meeting since the vacation season. The hosts of the evening were Messrs. Frank M. Garden, Edward F. Garden, and Hugh M. G. Garden.

THE following-named gentlemen have been chosen as a Jury of Selection and Hanging Committee for the coming architectural exhibition by the T Square Club of Philadelphia, which is to be held at the Pennsylvania Academy of the Fine Arts in connection with the Sixty-sixth Annual Exhibition of Painting and Sculpture opening in December, 1896.

WALTER COPE, *Chairman.*
EDGAR V. SEELER.
LOUIS C. HICKMAN.
DAVID K. BOYD.
WM. L. PRICE.
ADIN B. LACEY, *Secretary.*
Room No. 77 Brown Bros. Building.
JOHN M. CARRERE,
Pres. Society of Beaux Arts Architects.
ROBERT D. ANDREWS,
Pres. Boston Architectural Club.
ALBERT KELSEY,
Pres. Philadelphia T Square Club.

MAXIMS FOR DRAFTSMEN.

THE power of shading rightly depends mainly on lightness of hand and keenness of sight; but there are other qualities required in drawing dependent not only on lightness, but steadiness of hand; and the eye, to be perfect in its power, must be made accurate as well as keen, and not only see shrewdly, but measure justly.

Nearly all expression of form, in drawing, depends on your power of graduating delicately; and the graduation is always most skillful which passes from one tint to another very little paler.

In darkness of ground there is the light of the little pebbles or dust; in darkness of foliage, the glitter of the leaves; in the darkness of flesh, transparency; in that of stone, granulation; in every case there is some mingling of light.

An entire master of the pencil or brush ought, indeed, to be able to draw any form at once, as Giotto his circle; but such skill as this is only to be expected of the consummate master, having pencil in hand all his life, and all day long; hence, the force of Giotto's proof of his skill.—*Ruskin.*

Practical Schools of Brick Design.

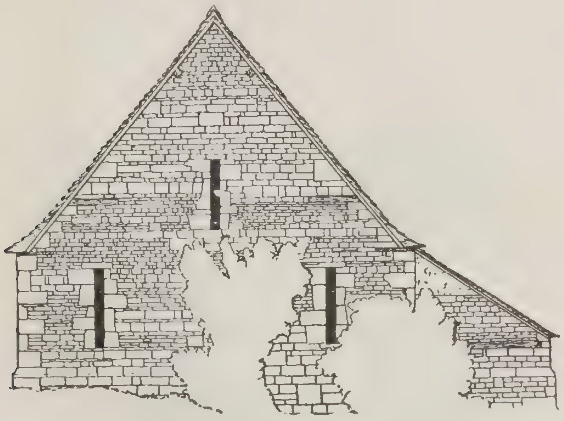
BY ROBERT D. ANDREWS.

ANY one who has traveled much in Europe, and made good use of his eyes, knows that there are to be seen among the old buildings many delightful ways of employing brick with which our masons are not familiar. If the architect wishes to make use of any of these treatments of brick design in his practice to-day, he finds himself in a hard position. The difficulty is to convey his knowledge to the man who has to do the work. If, on the one hand, an architect were himself handling the trowel, or if, on the other, the mason had only seen the original work, all might be well; but, as it is, the result is likely to be far from satisfactory. So difficult is this situation of the architect and the mason, that I am sure many beside myself have wondered at it and have despaired of getting good results under such circumstances.

Now it occurs very naturally to one knowing all this, that it may be possible to establish training schools where these experiments in brick masonry may be undertaken under more favorable circumstances than as now at the building itself. The architects and the makers and sellers of brick are alike interested in minimizing the chances of failure in what is undertaken, and in increasing the range of what they may successfully undertake. The architect's task so becomes an easier and pleasanter one, and the employment of brick more general.

It seems as though the larger cities could accomplish something in this direction without any very great outlay, either of time or money. Each such city has its Association of Master Builders, to whom one would naturally look for the forwarding of the movement, and the brickmakers, by reason of the large pecuniary interest that they have in the more extended use of brickwork, might be glad to contribute in various ways.

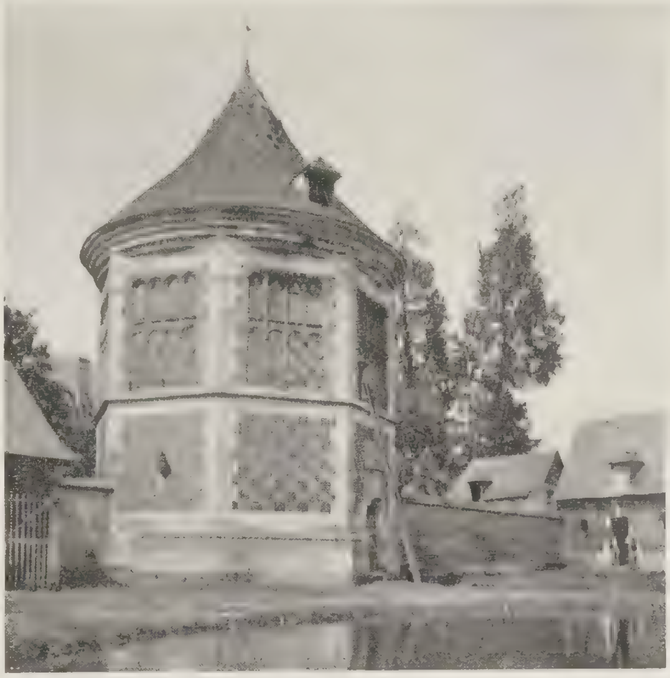
What seems to be essential is, first, the systematic collecting of photographs and drawings of good examples of artistic masonry; and second, a convenient plot of land where these examples may be in whole or in part actually reproduced. This plot of ground might possibly be found in connection with one of the trades schools which are everywhere springing up, or it might be a union yard leased in common by the brick-men for the better display of their goods. Such a spot would become a sort of center to which architects would go to make their selection of materials and actually test new combinations of texture and color before specifying them. The stonemen might also be led to join in the scheme, so that all the comparative effects of material might be practically studied in this one yard.



WITHINGTON MANOR FARM BARN.

Now, there is nothing in this scheme just outlined that is impossible. If the thing be desirable and worth doing, it can certainly be done. The real question is, what would such a movement benefit those who undertake it, and is it a step in the right direction?

Let us suppose that as a result of such a movement some dozen or two young masons were yearly sent out in each community with a fairly wide knowledge of the best work of their craft that has been done in former times. Let us suppose that they have made themselves acquainted with a large range of examples similar to those which are selected to illustrate this article. They have made drawings of the arrangement of the more celebrated instances, and have built in the school yard just such examples as these, and have seen other young men there who were practising the same effects; so that in case they were told to get, with local materials, a somewhat similar effect to that of a particular pattern on the Château d'Ango, they could attempt the problem with confidence and pleasure.



PIGEON-HOUSE AT BOOS.

Here, obviously, is a very great gain. The young masons have been brought into their legitimate inheritance as craftsmen. The possibilities of their work are greatly extended and they respect it the more. Its processes have more significance to them, and they are brought nearer to the architect's point of view. They get an architect's idea better for their training, and his drawings and instructions have a significance which they could not have otherwise. Under such circumstances they would work to better advantage, more rapidly, and with more confidence.

The trouble is, now, that if the architect makes a drawing of a certain piece of wall, he must either invent the variations which naturally come in rubble work, or else must make a conventional representation of the design. If he does the latter, — and almost all drawings are of such description, — the workmen tend to imitate the hardness which is inevitable in the design thus presented. The little accidents which make the work in the illustrations so charming and flexible in its look are eliminated by them as far as possible in order to make their work look like the drawing; and this is exactly what the architect does not want.

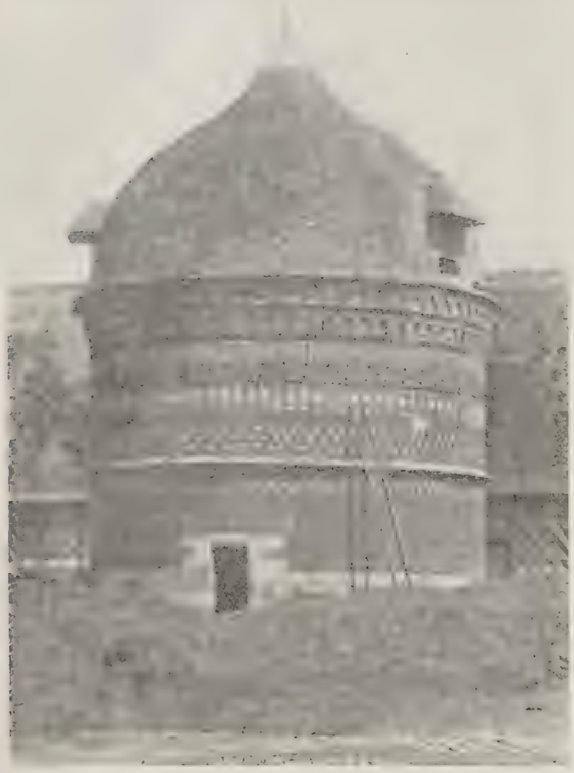
One of the illustrations shows the gable end of an old barn in England built in the fifteenth century, which I have reproduced here by the courtesy of the publisher of *The Quest*, because, although entirely of stone, it exemplifies so clearly the principle involved. The freedom with which the different-sized courses of stone are combined gives the work an indescribable charm, like a woven fabric. If an architect to-day wished to get this effect, he must either draw it out at very large scale and demand of the masons a Chinese-like copy, or he must trust them to a very considerable extent. As the first method would be impossible, on account of obvious reasons, and the latter is at present impracticable, it follows that we are debarred from getting masonry of this description.

Now, how did they get it in the old days? Simply by having the man who designed it build it.

Mr. A. S. Dixon, in writing in *The Quest*, of March, 1896, treats very intelligently of this subject. He says: "It is supposed that the medieval craftsmen went about the country in gangs and companies under the lead of their foreman, who must have been very much of an architect, building churches and manor houses and cottages. By working always together they formed a distinct style and tradition of their own, and in different parts of the country one can recognize a similarity of style in most of the buildings of medieval date. It would be much the same as if nowadays builders were always their own architects, or architects their own builders."

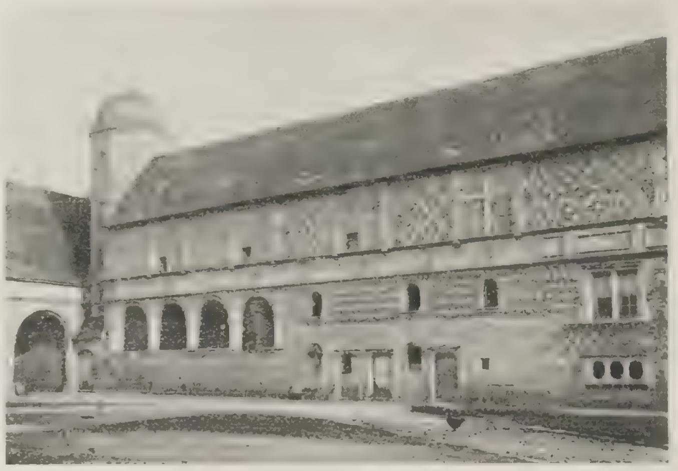
This brings us to the whole root of the difficulty, which is that in the building crafts design and execution have become widely separated. The two things naturally take their rise together; and this old work which we have illustrated is of good design solely because it was developed out of the situation in which the workman actually found himself, and was developed by *him*.

The farther back we go in the history of the original styles the more we lose sight of the architect as a professional man, and the more design rested in the hands of craftsmen.



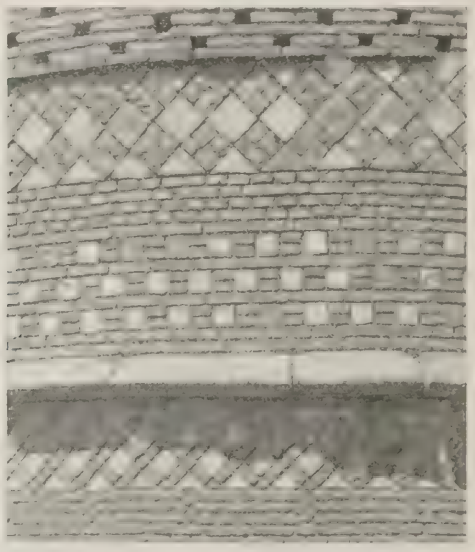
PIGEON-HOUSE, MANOIR D'ANGO.

I cannot refrain from quoting at some length from the introduction written by Mr. J. Alfred Gotch to his two volumes upon the Architecture of the Renaissance in England. The time he is treating of extends from about 1550 to 1650, — from the beginning of the reign of Queen Elizabeth. "It must always be borne in mind," he says, "that those days were widely different from ours. In the present day, if we are struck with the beauty of a building, it is a matter of no great difficulty to ascertain who is the architect, and in all good work we may safely conclude that it is to him we must attribute the happy faculty of giving his materials the forms and combinations which delight us. It is he to whom the rare and crowning glory of design belongs; the workmen are but the ministers of his will. Not so in the period under review; the architect, as we know him, did not exist. The term, indeed, was hardly known. It is only once used by Shakespeare, and then only figuratively. It is important to bear this in mind. To talk of the architect of Kirby, or Hatfield, or Wollaton, is really misleading. There was no such functionary. There was some one who rough-hewed those buildings, but it was left to others to shape them. There was in most instances an individual who supplied a plan, and often also an idea of how the building was to look outside, and therefore this individual's influence was of considerable importance, since it was he who gave form and shape to the structure; but he was not what we think of as an architect. He was called the surveyor, and the surveyor's share being done, his work was elaborated by numerous and insignificant artisans. Having before them the surveyor's general notion of the building — that here was to be a plinth, there a stone cornice, and there a balustrade; that between those windows should be a niche, and between the others a pilaster — it would then seem, so far as we can at present ascertain, that the masons set to work to carry out these ideas in the actual building, themselves supplying the profiles of the cornices and the patterns of the pilasters, and the sections of the mullions. Not infrequently the employer stepped in and said, 'Inscribe me here such and such words,' or, 'Carve me there mine arms, and those of my lady,' which, accordingly, the mason did to the best of his ability, and when he knew nothing of Latin, or was ill acquainted with heraldry, the result was apt to fall short of what was intended.



MANOIR D'ANGO, COURTYARD.

'But if the mason was instructed only as to the general masses



DETAIL OF PIGEON-HOUSE, MANOIR D'ANGO.

of the building, the carpenter and joiner received even less guidance. There were no sections of the building supplied, showing them the internal treatment. The plan was their only guide. . . . It was the same with the plasterer. He had his stock of designs, which he submitted to his employers without any regard to the surveyor. At Cobham Hall we learn from a letter of the Clerk of Works to Lord Cobham, how ‘the plasterer would be sent for to come to bring to yo Lo. modells or paternes of the maner of the sealing that yo I. maie make yo choice of that kind of work that shall best like yo.’ ”

MANOR HOUSE, ARCHELLES.

This state of things, in which the craftsman had so much liberty, may well mystify us who are accustomed to the routine methods of to-day, but the more one ponders the subject the more natural it seems. Our present condition is an extremely artificial one, and we turn out buildings as rifles, or watches, or locomotives, are turned out of shops. The different parts are allotted to different men, and all work according to patterns which are given them, and which they must follow exactly. This is an excellent money-making principle to follow, but it is destructive to artistic effects; and I believe that we have reached a point where it is apparent that to get artistic work we must, in some degree at least, depart from these artificial methods.

The thing to achieve, of course, is to bring the designer and the workman together, and how can this be done better than by bringing them together during their period of training? The building interests of each city ought to see to it that there is a place where their young apprentices may study photographs and drawings of the best examples of what their respective crafts have done; but this is not enough, for such learning without a chance to acquire it in practise would be of little value. They should have an opportunity to set up in actual materials the examples they have studied; and the younger architects should go — and without any question would go — and learn about these things themselves. It is not pleasant for an architect to be obliged to make his experiments at the expense of his clients, with all the probable chances of public failure.

CHAPEL AT PAGNY.

If, therefore, it were found feasible to start such a yard as I have suggested, and make it a center for experimental study of the treatment of building materials, the architects, I am sure, would do all in their power to support the scheme. They would find the resources of their art increased, and there would be more pleasure in attempting new and varied effects. As the designer and the craftsman come closer together and acquire confidence in each other, they gain in freedom, and the work shows it. Certainly a clever young mason, who has made himself familiar with work such as I have illustrated, and who is competent to execute it from the mere suggestion of the architect, ought to find constant and highly remunerative employment. He would become, in fact, an artist workman, — just what the workmen were four centuries ago in Europe.

All parties interested would be benefited. The man who furnishes the materials is concerned very greatly to have them appear at advantage in the building, for so it is he gets his trade. The owner certainly wishes such a result. The workman himself takes vastly more pleasure in his work and is better paid for it, while the architect is relieved, to some extent at least, from a very embarrassing practical dilemma.

Few people realize the extraordinary pains which a modern architect has to put into such a piece of brickwork as the “ Harvard Gates,” for example, to secure an effect equal to that of old work. The expenditure in time and energy is so great that few men are willing to give it. Yet it is exactly that sort of pains that makes the difference between effective and commonplace work. A man like McKim can make a brick fashionable and vastly increase its general use, simply because he takes pains that it shall look well.

Is it not, therefore, of very great value to the manufacturers of brick that they should interest themselves in securing conditions which will make their goods habitually appear to the best advantage, — and by this I mean the education of young masons? Have the best manufacturers anything to fear by joining hands in the establishment of a yard where their bricks may be actually set up and seen under normal atmospheric conditions? and would not such a movement result in greatly extending the employment of their product?

OUR buildings should, both outside and inside, have had some of that warmth which color only can give; they should have enabled the educated eye to revel in bright tints of nature’s own formation, whilst to the uneducated eye they would have afforded the best of all possible lessons, and, by familiarizing it with the proper combination of color and form, would have enabled it to appreciate it. Street.

Architects' Troubles with Brickwork. I.

BY F. E. KIDDER.

UNDER this title the writer proposes to discuss the more common troubles which architects meet with in their endeavor to get a first-class job of brickwork. These troubles, it is believed, are most aggravated in the smaller cities and towns, and especially in localities west of the Mississippi River, although many of them are sure to meet the architect everywhere.

POOR BRICKS. In many localities the difficulty of securing good brick is a very serious trouble. In almost every kiln of brick there are some underburnt or "salmon brick," which the brickmaker must dispose of in some way to get a profit out of his business. He, therefore, tries in every way to work them off, and, as they are sold at a less price than the harder-burnt bricks, the contractor will generally try to use as many of them as he can get the superintendent to pass. It is probably needless to say that these brick are much inferior both in strength and durability to hard-burnt brick, and should not be used in walls exposed to the action of the weather, or wherever they have to sustain any great weight. The great trouble, wherever they are permitted to be used at all, is that the mason is quite sure to use them wherever he can without being discovered by the superintendent.

In many localities coal slack is mixed with the clay of which the bricks are formed, so that even the bricks that are well burned are very poor, indeed. The quality of common brick varies greatly in different localities. In many localities, and particularly in some of the Western States, the best common brick are not much, if any, better than the salmon brick made around Boston. Another difficulty in getting the desired quality of brick, that the writer has met with, is in the local classification of bricks. Thus in some localities there are salmon brick, red brick, hard brick, and arch brick; the red bricks being commonly classed as a "well-burned brick," although they are often not much better than a good salmon brick. The writer has had bricks delivered at his buildings that could be broken in two in the hands, or could be crushed by the heel, being really nothing but a mud brick. These bricks were mixed in with hard bricks, and much watching was required to prevent their being built into the wall.

LAYING THE BRICKS DRY. It is the opinion of the writer that the importance of wetting bricks before laying is not as generally understood as it should be. In warm, dry weather no bricks should be laid in a wall until they have been well wet, and the more porous the brick the greater the importance of their being wet. Brick-masons, however, do not like to wet the brick, not that it costs anything to speak of to wet them, but the water that the bricks absorb makes them much heavier, so that the hod-carriers cannot carry as many bricks, and the wet bricks are also hard on the hands of the bricklayers. If, therefore, the brick-masons can find some way of getting out of wetting the bricks they are quite sure to do so. The writer has known several instances where they have gone to the owner and tried to convince him that the wall was better for not wetting the bricks.

In building a brick church in the country, to which only occasional visits were made, the writer found on the first visit that the masons had been laying the bricks dry, although the specifications required that they be wet with a hose, and the building committee had been especially cautioned to see that it was done. Upon inquiry it was found that all the old brick-masons in the town had told the committee that they always laid common bricks dry, and that these particular bricks would not stand wetting, and the committee, like too many others, concluded that the architect was not posted on practical brickwork. The only way to convince them of the importance of wetting the bricks was to go around and lift several bricks from the wall. In every case the bricks came up with the bottom bed *as clean as before they were laid*, the bricks being so dry that they had absorbed the moisture from the mortar, and thus prevented adhesion. The contractor was finally made to admit that the wall was stronger for having the bricks wet, and the eyes of the committee were opened.

MORTAR. Very often the architect is troubled with the quality of the mortar used. Masons, in all localities, are very apt to put in too much sand, and in localities where several qualities of lime are sold, they are quite sure to buy the cheapest quality, assuring the architect or superintendent that "any lime is good enough for brick mortar." This is not so, and no lime should be used in brick walls that will "pop," especially if the plastering is to be applied directly to the wall. To secure the best work it is important that good lime, in the proper proportion, be used, and that it be slaked a week or ten days before using. When the writer first came to Colorado, it was quite a common practise with brick-masons to mix a fine, sandy loam with their mortar, saying that it "made the mortar work better." In one sense they were right, as the loam, being fine, helped out the lime, and the mortar left the trowel cleaner than would have been the case had the *same proportions* of lime and sand been used without the loam. The real object in using the loam was that they might *save on the lime*, the difference in the cost of the two naturally being very great. It should be hardly necessary to say that the use of loam in mortar greatly deteriorates it, and it should never be permitted. Whether or not this custom has been practised in other localities, the writer does not know.

SKIMPING THE MORTAR. This is another very frequent source of trouble to architects, especially where there is sharp competition, and the work is let to the lowest bidder. The strength of a brick wall certainly depends as much upon the quality, amount, and adhesion of the mortar and the bond of the wall as upon the quality of the bricks, but many masons seem to care very little about the strength of their work, provided it looks all right on the face, and will be accepted when finished. It is not uncommon in the West to see the middle course of bricks in a 12-in. wall laid dry, and a little mortar spread over them, to make it look all right. If such a wall were taken down it would be found that the joints at the sides and ends of the bricks contain very little mortar, and, of course, in such a case there is very little adhesion in the brickwork and consequently very little transverse strength or resistance to buckling.

BONDING. In bonding the walls the masons seem to have a prejudice against having the bond courses too near together, although it does not require any more bricks. Where ordinary bond is used, however, the frequency of the bond courses shows on the surface of the wall, so that there is not much chance to deceive the superintendent in this particular. The greatest defect in bonding, as observed by the writer, is in the bonding of the face brick to the backing. Generally diagonal headers are used, and very frequently these are seven or eight courses apart, and only one header to every other brick. Diagonal bond is a poor bond at best, and when used a header should be used to *every* outside stretcher, in the bond courses, and the heading courses should not be more than six courses apart. The better practise is to use the Morse wall tie, if plumb bond is desired.

FACE BRICKWORK. The difficulty of securing good face brickwork is often a very vexatious trouble to the architect, as a poor job cannot be concealed and is always an eyesore. As a rule, this difficulty is not so much in having the bricks laid well as in getting a uniform shade of brick. When a mottled effect is desired there is not quite so much trouble, but even then if several bricks of the same shade are laid together, and then more bricks of another shade, the wall will have a very "patchy" effect. In a large front it is often a very difficult matter to get a piece of brickwork that will be uniform or harmonious throughout, and not show alternate streaks of light and dark shades. Even when the bricks are of the same shade, a difference in the wetting of the bricks will often cause a difference in their appearance when laid, which does not always disappear as the wall dries out. In the opinion of the writer pressed brick should never be wet down with a hose, but should be dipped in a bucket of clean water on the scaffold. They should also be kept covered in the pile, as a heavy rain will often discolor them. In the laying the greatest difficulties, probably, are to keep the walls plumb and the courses horizontal, with the end joints plumb above each other. Where bricks are laid from the inside, as is the usual custom in the West, the courses at the scaffold level are very apt to get pushed out, and should be carefully watched. A very slight displacement of a brick will show up very prominently when the sun shines on it. Another point that must be watched is the thickness of the joints, that is if close joints are desired. It is much cheaper to have a wide joint than a close one in any kind of brickwork, and the masons, therefore, prefer to lay as wide a joint as the architect will permit.

Cracks in Brick Walls often cause a great deal of trouble, and are sometimes hard to prevent. They are generally due more to improper planning of the foundations, and to lack of sufficient ties, or other precautions on the part of the architect, than to poor work on the part of the contractor, although they are more likely to appear in a poorly built wall, especially if soft brick are used, than in one that is well built with hard bricks and first-class mortar.

Efflorescence on Brickwork, fading of mortar colors, and the stopping of chimney flues also tend to make the lot of the supervising architect an unhappy one. *How to overcome these troubles.* Many of the troubles herein mentioned can be largely, if not entirely overcome by the knowledge and foresight of the architect, and in the next number the writer will endeavor to show how, in his experience, they may be best avoided or reduced to a minimum.

THE principle which artists now have mainly to contend for is that of TRUTH. Forgotten, trodden under foot, despised, if not hated for ages, this must be their watchword. If they be architects, let them remember how vitally necessary truthfulness in construction, in design, and in decoration is to any permanent success in even the smallest of their works.

Street.

FIRE-PROOFING FLOOR OPENINGS.

IN estimating risk in a fire-proof building used for purposes other than offices, such as stores and warehouses, one of the most important items to be considered is the manner in which the floor openings are to be protected from each floor stock in case of fire. In these openings may be included freight or passenger elevator shafts and stairway or hallway shafts.

In buildings used for storage or manufacturing, where little attention is paid to finish of doors, trim, etc., the usual standard metal-clad door and heavy wire glass windows may be used with iron jambs and lintels.

In a building in which many people are constantly moving in and out, and where taste and design are generally considered more important than protection from fire, the difficulty arises of providing proper protection.

If the hallway shaft, which may contain stairs and elevators unenclosed in fire-proof shafts, is separated from each floor stock or main area by fire-proof partitions with standard doors, lintels, jambs, and windows, a considerable reduction may be made in charging for internal exposure. The question then arises whether this reduction in insurance would pay for the outlay necessary in putting in these doors and this trim. In most cases it would pay; because when once done the reduction is permanent. But there again arises the question, how can this be done without spoiling the general refinement of design? There seems to be a field of success for some one who will invent an absolutely fire-proof material for trim and doors, including jamb, lintels, etc., which may be suitable in appearance and easily worked.

In the new building on the corner of Union Square and 17th Street, a new scheme has been evolved which has apparently met with the necessary approval of the insurance companies without losing anything particularly in its treatment of finish or taste in its designs.

(*Continued on page 170.*)

Notes on the Design of Brick Buildings.

BY GEO. F. NEWTON.

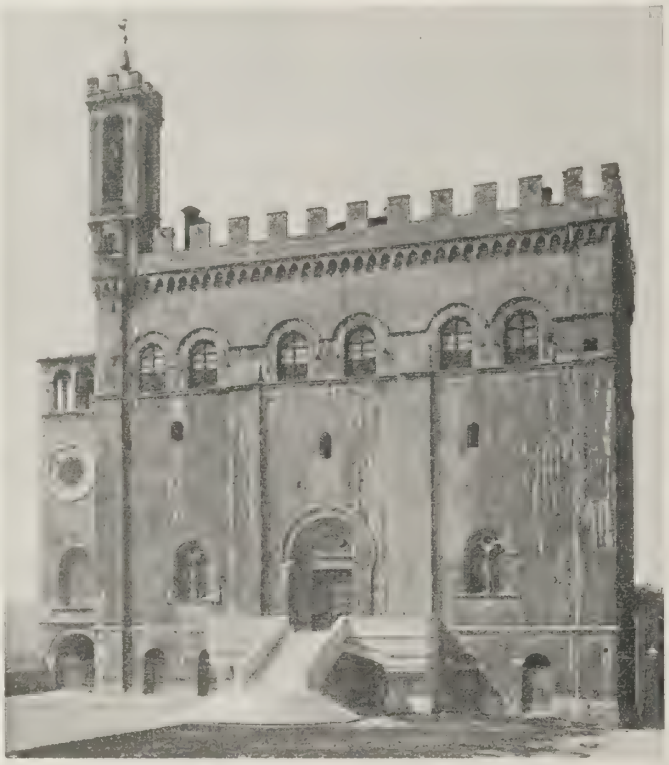
IT is of the greatest importance to the student of architecture to train his imagination that he may see his buildings in their various forms and possibilities as the plan is developed. The architect must see his creation definitely in his mind's eye in the location for which it is designed, and also see its organism plainly if he does not wish to be disappointed in the end. This ability to see a conception and work it out in one's mind is most valuable, in fact, indispensable to a successful issue. It was the habit of a famous architect, and is probably of many successful architects, to work out his problem in his head carefully before touching pencil to paper, and his thumbnail sketches, or the results of this mental modeling for the guidance of his assistants, are marvels of accuracy. This ability is only acquired by constant exercise of the imagination and wonderfully assists the creative faculties.

It is not only necessary to see the building, but its effect when modified by surrounding objects; and there are many remarkable proofs of the complete dependence of architecture on its situation and of the utter impossibility of judging of the beauty of any building in the abstract. The nature of the situation will demand usually some recognition of it in the building. There are as many forms of edifices as there are peculiarities of situation, and if we abandon the idea of correspondence with the situation we lose oftentimes the most valuable accessory for a successful general effect. In certain cases it is the most important consideration to secure a happy general effect with the surrounding objects. The general aspect of the country, if severe and bold, or domestic with cultivated fields, will be considered by the trained architect and will influence his design. This is akin to the field of landscape architecture, and the education of the architect is sadly neglected who has not given this side of his art serious study. In the magnificent modern villas in the Berkshire Hills we see, within a radius of ten miles, an Italian villa, an adaptation of the feudal castle and the English house; and a Francis I. château will doubtless appear in time. It surely has the charm of novelty; but to the sensitive it must seem somewhat incongruous for the resident of a stately, narrow-windowed Elizabethan house to be transported to the adjoining estate, to enjoy hospitality at a brilliant Italian villa with characteristic furnishings. Of course the owner has the privilege in the country on his extensive estate to indulge his preferences and surround himself with any period of art which most interests him; but this does not affect the truth that certain types of buildings harmonize best with certain characteristics of country. We labor under a certain disadvantage in not possessing a national style. If the Italian villa were a national type for rural buildings, it would take its place quite naturally in Berkshire country. Under the same circumstances the Tudor house, perhaps, would there seem as appropriate as among the hills of Somersetshire. There are situations where the horizontal lines of the Italian house harmonize as no other type can with the curves of the hills and contrast beautifully with the upright lines of pine and poplar, when the vertical lines and gables of a Tudor house would be discordant. The design of the dwelling is sometimes controlled by a great elm, or other peculiarity of the situation. A group of delicate locust trees would demand a different treatment of the house from that which could associate with a group of sturdy oaks. So it must be in the infinite variety of circumstance of situation, to say nothing of the peculiarities or eccentricities of the owner or of the building itself, which must be considered and to an extent expressed in the dwelling.

In the same manner the building in the city must be analyzed. A certain conception, however beautiful of itself, may be ill-suited to one location and its beauty greatly impaired by environment. Good taste and feeling for the fitness of things are essential to the successful practise of architecture, as without them the most chaste and otherwise carefully thought-out building will not give the pleasure it was designed to inspire. The nice judgment necessary to the architect in selecting from many possibilities the most appropriate design in scheme, proportion, and color, which conception will be the noblest, the most beautiful and best adapted to its purpose, require what a few seem to be to some extent happily endowed with, an innate sense of the appropriateness of things, while with the greater number this must be cultivated by untiring research and observation.

Of the mode of uniting a building with the near features of foliage and ground or the complications in this regard in city architecture, it would be utterly useless to speak; it is a question of infinite variety, involving the whole theory of composition, so that it would take volumes to develop principle sufficient to guide us in a result which the feeling of the practised eye would arrive at in a moment.

A wide range of knowledge must also be acquired to design buildings which will harmonize with the great variety of conditions in their environment. Problems with their many considerations must be logically thought out instead of applying some favorite motive, or leaving to the tender mercies of the draughting room to fulfil all the conditions. The head must do the work first, a good idea must be culled from a well-stocked mind if an appropriate architectural building is to be the result. It requires much skill to so arrange the parts of a building that it will be architectural, and still serve its uses well. The scheme sometimes comes to the architect in the crudest possible shape, probably worked out as the client may suppose in its most convenient arrangement, and he expects the architect to put an architectural dress upon it and retain his plan. The client's version of the problem may not be the best, and the architect cannot work intelligently until he has become acquainted with the actual requirements. The shortcomings of our architecture can seldom be laid at the door of the owner. He would not employ an architect if he did not expect architecture, and he will usually accept an equally good or better solution if thereby its exterior be benefited.



MUNICIPAL PALACE, GUBBIO, ITALY.

He is even willing in many cases to put up with a moderate amount of inconvenience when necessary, if his building will be more beautiful. The rearrangement of portions of his scheme is not for the object of disguising the character of the building, but to give it more agreeable proportions. The uppermost thought should be to express the uses to which the building is to be put, as character is of the first consequence. There are many kinds of buildings which the architect is called upon to do, and to preserve the character of each is more important than to give them a particular historic style of architecture.

It is frequently thought necessary to add a tower or other decidedly marked feature to a building such as an armory, storage building, or factory, solely because the designer thinks it becomes more imposing or the composition requires something to ennoble and dignify it. There is sometimes a misconception in this respect; it does not seem right to add extraneous features to a building to make it seem imposing, or invent uses for features not naturally required in the scheme.

Certain buildings of their very natures cannot, nor should they, awaken elevated ideas, nor assume nobility of form; they can have none of the grace of beauty nor of dignity which another class of edifices may assume, but must be structures of every-day life, a protection from inconvenience and exactly typical of their uses, regularly planned, mechanical, well-thought-out buildings.

We have seen many buildings in Europe with masses so happily arranged as to agreeably express the nature of the building, where dignity or picturesqueness is secured by emphasizing, perhaps, its peculiarities without the invention of these larger motives which really belong to buildings of another character. We see about us such a medley of appropriated motives that the public is daily being deceived in its judgment of what is good taste in composition. We find towers used in the acknowledged best periods of art where they have a useful purpose. They were not applied indiscriminately to make the composition interesting. They were constructed as places of observation, then for city halls, partly for the same purpose, and also very properly to indicate the municipal wealth of a prosperous community. The campanile had its use, and this was merged into church buildings in various forms, all for a purpose. And now we see a fitness by historic use of the city hall tower and the church tower.

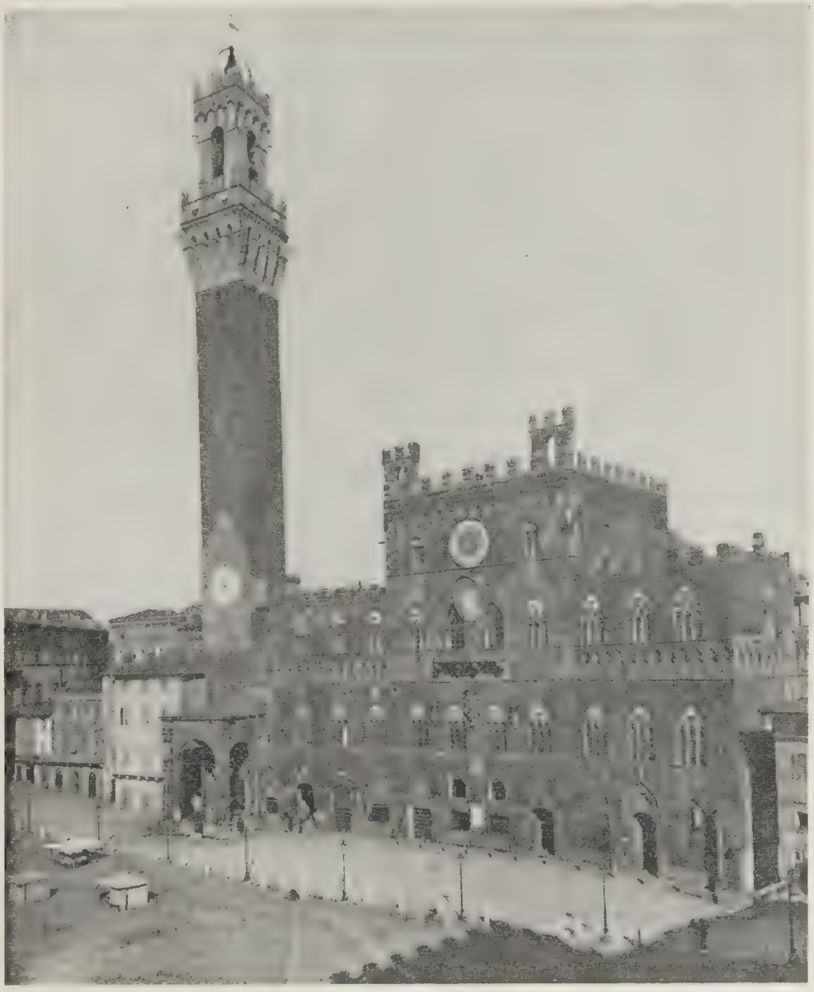
In modern times the tower has lost much of its suggestiveness, and consequently its character and dignity. It is applied to almost any building, by the thoughtless architect or the client who demands that his project shall overtop his neighbor's and proclaim his vanity. The trained architect may design a high or tower-like portion of a building, and model it in such form that it will not compete with a city hall or church. Why should a school or academy building have a tower? We cannot recall any of the college buildings of England which boast of towers save their chapels. Engine houses are a modern invention; the problem demands a place for drying hose of lengths of perhaps 100 ft., which means in a building of two stories a tower-like structure of perhaps 100 ft. in height. Some of these structures, which should be simple, vie with the town halls of Italian cities, their towers modeled after the belfry of the Municipal Palace in Florence, with a lookout as in the days long since past, when the watchman kept his vigil over the city day and night. If a tower is needed for the purpose of drying hose, and solely for that, it should be so designed to fill this use with a pleasing outline and simple adornment, and placed where it will compare well with the building. It is perhaps as much from the desire to use the opportunity for all it is worth as from want of appreciation of the fitness of things that this abuse is caused. This is a species of error which it is very difficult for persons paying superficial attention to architecture to avoid. The trained architect seldom makes this error, as he has acquired the sense of appropriateness by his study of historic architecture. Sometimes a project calls for a high object, a water tank, or ventilation shaft, or a chimney. It is not good architecture to treat it as a campanile with clock and observatory. These objects may demand a high structure on or near the building, and they can be treated in a quiet or picturesque way as conditions demand, and not made conspicuous objects when their uses are merely utilitarian, perhaps for the sole excuse of an opportunity to display skill or the use of a favorite model. There are certain buildings where a tower seems appropriate, as in one devoted to public uses. The great

Cloth Hall at Ypres is worthy of its majestic tower and implies a wealth and importance of a widespread national industry; the building of the character of the Trocadero at Paris seems right with its tower; or an important group of buildings or a railroad terminus may be marked by a tower. There are comparatively few instances where the tower should be used. Our architecture is restless; towers, gables, bays, tourelles, etc., produce nervous, agitated lines, cutting up the structure into small parts, destroying all breadth and nobility; and these buildings must remain for years with their tiring influence on the eye of the distracted wayfarer.

The architect should consider well what effect on the beholder he wishes his buildings to produce, what story he wishes them to tell. They should speak as plainly as the sculptor's group or the painter's canvas. Its purposes decide for the designer. To a sound building he may add nobility, magnificence, or chasteness. "The value and rank of every art is in proportion to the mental labor employed in it, or the mental phase produced by it." As this principle is observed or neglected our profession is advanced or retarded.

The dome, like the tower, by its appropriate use may crown the stately capitol or cathedral church, and form the central object of a great city. A less ambitious form of the dome may, with skill, be appropriately employed in a great variety of buildings, its form and decoration being modeled as the exigencies of the case require and always controlled by the trained architect. It is so with the various features or forms handed down to us by past ages, the pediment, cupola, etc. The appropriate use in the composition, the knowledge as to whether the building will warrant the employment of these larger, nobler forms, must be obtained by a study of precedent and by years of training — true feeling for the fitness of things. There is no form in architecture possessing greater dignity than the pediment with its stately portico, but this feature is appropriate to but few buildings. We sometimes see in a city street a pediment attached to a merchant's house worthy of a president's mansion. Grand forms lose their value when misapplied. A dignified frontispiece requires something back of it more than a citizen's dwelling. We see over our land the echoes of the World's Fair buildings in the citizen's house or civil building, all of which indicate remarkably good taste in the selection of a type for admiration, but a lack of appropriateness in its application. What will the architect do for forms in college or municipal buildings if the individual appropriates these monumental forms in miniature for dwellings? We see all three — tower, dome, and pediment — employed in a cathedral, but they would be ignoble in a small edifice.

It will bear repeating that the material should in a great measure control the design of a building in hand. How can a design for granite be executed in bricks or marble on the same lines, and *vice versa?* Yet this is done frequently. The design is made with no reference to material. This is left for later consideration. The same drawings stand for a building of granite, white marble, or terra-cotta and brick. This saves time, no doubt, but is it architecture? How rarely do we see a building entirely successful? It is lacking in some quality, indicating that the architect overlooked certain considerations. Time is necessary even for a thoroughly equipped architect to do good architecture, and too few are willing to give it.



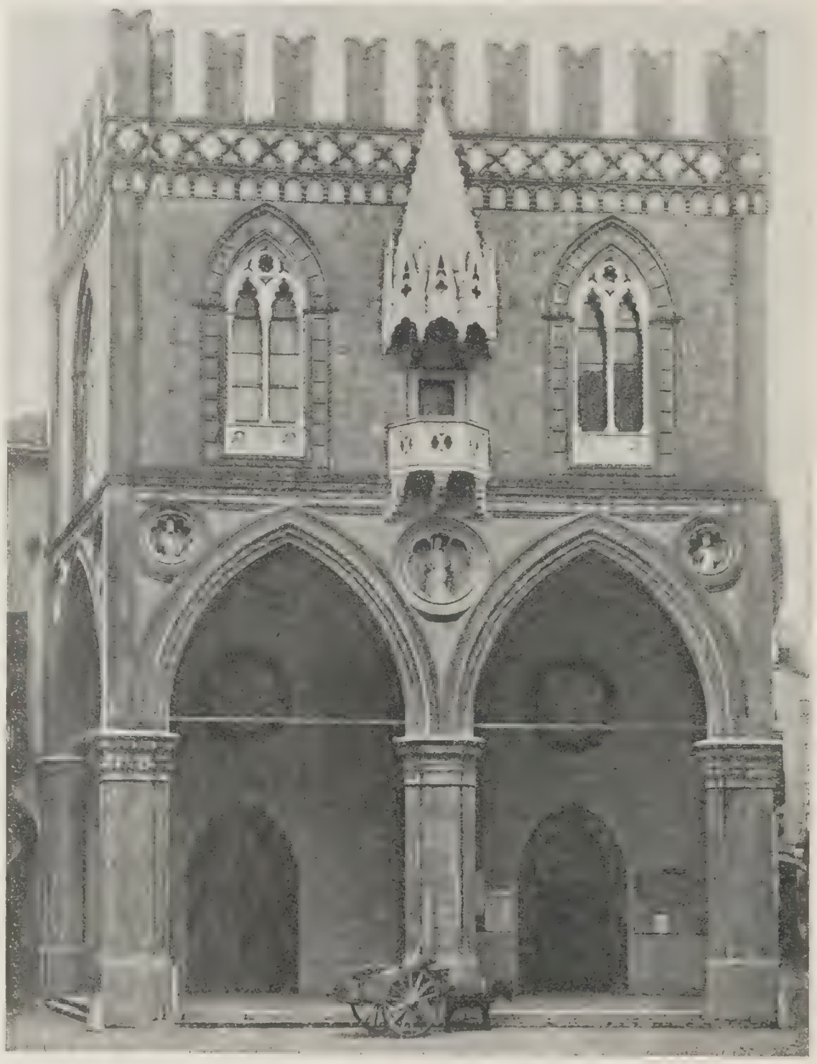
MUNICIPAL PALACE, SIENA, ITALY.

There are many brick buildings which have been treated in a manner characteristic of the material, making essentially a brick design, with perhaps a very limited use of terra-cotta or stone in portions where our climate requires a protection to the small material with many mortar joints. As remarked above, the uses of the building determine its masses or ultimate character. This in turn suggests, sometimes compels, the principle of decoration which should be employed on its surfaces. If the building is much higher than it is wide, campanile like, its principal decorative lines should be in sympathy with the form, which in this case is upward or vertical. No amount of horizontal bands will make it seem less high. Why should it not seem high? The architect should glory in this quality and take every advantage to emphasize this characteristic. The theory that the bands mark the floors does not at all assist the æsthetic effect. It is not of the first consequence to express what happens inside, but it is of the first importance to present a pleasing architectural exterior, and a too close expression of the interior is incompatible with good design. The reader will readily recall examples of these principles in historic and modern buildings where he may compare results in this general treatment of decoration. One does not expect repose to be the dominant element of a high object. Rather should he be inspired by its majesty, its soaring height, as if the thing rejoiced in its exhilarating upward flight. It should stand triumphant, with a firm hold on the earth and a proud crest, the intervening space simple, rigid, and strong.

The eye runs naturally to the summit of a high object, be it mountain or the structure of man, and there hopes to be satisfied, whether by sparkling snow-cap or exquisitely modeled cornice. What happens between base and summit does not make a lasting impression. On the other hand, one does not expect exhilaration of the senses from a long, low building, but a quality equally desirable and as necessary to human enjoyment. Here the decorative lines should be horizontal, and the less they are interrupted the more reposeful the building appears. It is folly to attempt by breaks and towers to add height to it. Better would it be if the neighboring church spire, a great tree or other high natural object would, by contrast, tell how low and quiet the long building really is, and the truly great architect will grasp this peculiarity of the location and construct a building which will by contrast or harmony add to the beauty of the scene, whether in the public square or in rural architecture.

Much of our enjoyment of architecture, as well as of natural scenery, is lost by failure to compare with objects with which we are familiar. The painter enjoys a beautiful view or a quality of light or tone because he has trained himself to appreciate the phases of nature. He goes forth each day enjoying the beauties unsuspected by others. It is so in relation to many works of architecture, perhaps unfortunately placed, as an architect can rarely control the surrounding objects, and by comparison his achievement will seem mean. The brutal, towering monster, built for utilitarian purposes, may swamp his carefully studied building which respects itself and may command the admiration of the few, but if there is a standard in the mind of the beholder, objects may be appreciated and noble architecture enjoyed, notwithstanding environment. How vast the mountain seems with the cottage nestling on its side, how glorious Amiens when compared with a figure entering its great portal!

For architecture the human figure must be the unit of appreciating the size or scale. It is specially imperative that the architect and the student shall have constantly in his mind this unit for measuring scale. There is none other reliable. Conditions and surroundings vary to such an extent that no other will answer. If in his travels or in his daily observation he forms the habit of mentally comparing the human form to the size of architectural objects, he will find that he has acquired a great assistance in judging of the scale of parts of his designs. Photographs which show the true comparisons of objects will be of greater value to him as a source of study. If he draws the figure on his scale drawings he will not build his church for the sanctuary of giants, nor an arcade which will permit the sculptured capitals to be profaned by the fingers of passers-by.


EXCHANGE, BOLOGNA, ITALY.

Architecture should not, by its scale of parts, belittle man, as is said of St. Peter's, but inspire and beautify his life. In the colossal halls of Egypt, such masses of architecture arose as we feel crushing down upon us with eternal weight, but by the delicate sculptured and colored reliefs on the walls and columns are brought into sympathy with the observer. In much of the Roman work the monumental masses are brought into a pleasing relation to the man by the fortunate scale of the decorative parts.

A structure of bricks may possess grandness of parts with this dwarfing and overpowering effect as much as stone.

The brick fortress of Saragossa and the ramparts of Perpignan are as impressive as Carcassonne or Angers.

If these brick units are emphasized in places near the eye by well-chosen detail, such as ornamental brick, this contrast between the mass and the detail would evidently be more apparent and add greatly to the scale of the edifice.

The study of scale and composition are closely allied, and the best way to study scale, whether in the relative masses of a composition or the disposition or size of windows, bands, or other ornaments, is by the thoughtful observation and comparison of buildings both old and new. One sees really comparatively few buildings entirely successful in this respect. A student should cultivate this faculty of comparison and improve every opportunity to test his knowledge and acquire better standards. The principal benefit of the measurement of foreign work is in obtaining a refined judgment of the scale of the work. The student should go out of his way to watch the erection of a building by an architect of known ability, in order to see the various details before they are placed in the building, where they will be inaccessible to him. He must also study them when in place in the walls. A study of this kind will be of immense assistance to him in obtaining a happy adjustment of parts in his buildings both of mass and decoration.

Between the very high and narrow building and the very low and long one there are innumerable variations in the treatment of masses and related parts. These may be considered in a study of special buildings. The title "Brick Buildings" will awaken, without doubt, a different idea in the mind of every one who reads these words. None will have any definite idea of a fixed character stamped on brick buildings. There are many styles of architecture which permit the building to be either of stone or of brick. The general design gives no clue as to what the material is. The outline or disposition of masses in these does not suggest any special material. There are also periods of art which one at once associates with a brick style of architecture, as in the buildings of Hanseatic and North German towns, or Italian medieval and Saracenic architecture.

The illustrations which are shown in connection with this article are borrowed from the collection of the Philadelphia and Boston Face Brick Company, who have given much time and money to securing the best examples of foreign brickwork wherein pattern brick have been used.

Fire-proofing Department.

Conducted in the Interest of Building Construction to Prevent Loss by Fire.

WHAT CONSTITUTES A FIRE-PROOF BUILDING MATERIAL?

BY PETER B. WIGHT.

ANY answer to this must necessarily imply that it is something which is not only incombustible, but not subject to become useless for the purpose for which it is intended, under the conditions to which it may be subjected. There are a considerable number of materials that fulfil the first condition, but few which comply with the last. In fact, many of the former are necessary in construction, and when so used must be protected by the latter. We have, therefore, less to do, in this consideration, with materials of construction than with those subject to destruction. Of the former brick and iron are the principal ones in use, and a later addition is found in hollow brick or hollow tile made of clay. All have great strength, and each is appropriate for a certain use. But iron and steel, which are the strongest building materials in use, are admitted to be only useful when strength alone is required. Brick is, and for a long time may continue to be, a standard building material, where strength of wall is required, having fire-resisting properties. But this is not the case with all bricks, for there is a great variety in the clays from which they are made and the manner in which they are burned. They vary from the underburned red brick, containing a certain proportion of iron oxides, to the No. 1 fire-brick, which contains very little iron. The former can only be manufactured by a low degree of heat, and the latter only by a high degree. It follows, therefore, that the low grade brick has bad fire-resisting properties, while the highly burned article has good fire-resisting properties. This has been repeatedly demonstrated in burned buildings, for it is not uncommon to find bricks melted off to half their thickness, chipped off to the depth of a full course, or entire brick walls cracked on account of too rapid absorption of heat. The unreliability of even the best of common brick was felt to be so great, when the first section of the Monadnock Building at Chicago was erected, that the owners lined the exterior walls with No. 2 fire bricks.

Hollow bricks and larger hollow tiles are also used for independent constructions, but not to so great extent or for such high and heavy walls as common bricks. As such they are subject to the same conditions of manufacture as bricks. But besides these a considerable number of other materials have been put on the market, manufactured in similar shapes and claiming to be fire-proof. These are all made of a plastic material, but not completed in their manufacture by burning. Then, for the lighter interior constructions, we have the same plastic materials used so as to come to a permanent "set" in position; and there is every grade of them from common lime and sand mortar and calcined plaster, to the highest grades of Portland cement. These ingredients are sometimes used for a completed article, and sometimes in combination with a stiffening and strengthening material, such as iron and steel in the form of bars, T's, L's, in sheets, or in the form of wire.

Experience has shown that they are all more or less useful according to the place in which they may be employed; but there is a large margin to the judgment that the architect may exercise in the use of these methods. Every right-minded man naturally desires to use the best, but it is not every one that succeeds in doing so. Of the plastic materials, none except the best hydraulic cements used in large masses have ever been proved by experience to be fire-proof. All thin coatings and combinations with wire and sheet metals have been proved to be inexpensive substitutes for more reliable methods. As far as the actual resistance to intense heat is concerned, common lime and sand mortar in small quantities, that is, when used for the joints between bricks, or as plastering in a brick wall, has greater fire-resisting properties than any other plastic material. It is not uncommon for the surfaces of bricks to be melted and the mortar joints to be left standing out from the wall like a honeycomb. The writer picked up in the ruins of buildings after the Chicago fire of 1871, complete honeycombs of mortar from which all of the bricks had disappeared except where they were melted and adhered like a thin glaze to the mortar. It also frequently happens that the plastering, when of lime and sand only, protects a brick wall when applied directly to it, when, under the same heat, an unplastered wall has been melted away on the surface. If lime and sand mortar had sufficient strength to be used in bodies four or more inches in thickness, it would be superior in fire-resisting properties to Portland cement. But as the latter only can be relied upon for constructive work in masses, it will continue to be the only plastic fire-proof material for carrying great weight.

The purpose for which a fire-proof building material is intended has been set forth above only in part, when referring to brick walls. For such it must have sufficient strength to resist compression, and a consistency to resist the most intense heat of a burning building. Let us see what this is. While in some conflagrations wrought iron has been melted, common experience has shown that few buildings burn with greater intensity than the melting point of cast iron. This is from 2,000 to 2,700 degs., according to quality. At 2,200 degs., iron assumes a bright orange color, and at 2,372 degs., it is at a white heat. The welding heat of wrought iron is 2,733 degs. The temperature of the roof of an ordinary reverberatory furnace which must be resisted by the best fire-brick is said to be 3,992 degs. All these are degrees Fahrenheit. It follows that any thoroughly fire-proof material used for interior constructions, to be of service in severe tests, must be such as will stand a heat of 2,500 degs. without losing its integrity, and fire-brick will easily do this. Of all known materials of such reasonable cost as to make it practicable to use them, clay is the only one that will stand this ordeal. It is the only material which can be so used that is itself the product of fire; and the degree of heat used in its manufacture determines the extent of its usefulness for this purpose. The deposits of nature give us all the varieties from the common loamy earth only valuable for making earthenware flower pots to the highest grade of refractory clay used in combination with other materials for making the best quality of fire-bricks. Each kind has its own vitrifying point, beyond which it cannot be burned without destruction, and any kind that will vitrify below 2,500 is not only likely to be insufficient in strength, but useless for fire-proofing purpose. If subjected to the test of such a heat, it will be found that many of the clays now used for the manufacture of fire-proof material are valueless for that purpose.

But, in every burning building, it is not only essential that the material shall resist heat, but, as stated in the first sentence, it must be useful for the purpose for which it is intended *under the conditions to which it may be subjected.* The most important, and often fatal, of these conditions is that it must preserve its integrity when being suddenly cooled. The cooling in this case is always caused by throwing cold water upon it. Water acts in two ways, and they are often counter to one another. One is by causing sudden contraction, and thereby cracking it, and the other is by the sudden expansion caused by its absorption and conversion into steam, thereby resulting in disintegration. The absorption by plastic substances, such as mortars and cements, also causes a chemical change, which is more destructive than either. In the case of clay materials the hard bodies are in danger of cracking and the soft bodies of expanding. There is, hence, a perpetual argument between the advocates of hard and porous clay products. Tests and experience in actual fires have shown that the value of the hard products depends upon their cellular structure, in which the protection is afforded by non-conducting air spaces; and it stands to reason that the greater number of these spaces the better service they will give. Thus far, when made of good refractory clay, nothing more than the outer surface has been destroyed in ceilings and partitions, when two or more air spaces were provided, admitting of repairs without taking out the blocks. The porous terra-cotta, miscalled often for commercial purposes terra-cotta lumber, depends equally for its value upon the quality of clay used. If the body is not firm and crisp and burned at a high temperature, which reduces every particle of the sawdust to ash, it is easily disintegrated by the steam formed in it when water is thrown on the heated surface. The best manufacture has resisted the destructive elements of fire and water better than the best hard tile, but the poorer qualities are inferior to either. It is an evidence of unsoundness if the surface of such blocks is easily abraided or makes dust, and it should always have a slight ring when properly fired. Among its advantages are the fact that the material itself is non-conducting, without regard to its cellular structure, and it can be made and used in the solid as well as the hollow forms. It is far superior for column and girder protection to any other clay product, and has for an advantage that it can be cut with saws. Its ability to hold nails is one which has not been proved by general experience.

In conclusion, it must be assumed that a true fire-proofing system can only be based upon the use of one and only one material, namely, hollow clay blocks for all interior and roof constructions, and the protection of iron and steel. Such may be either of dense or porous clay, and the best of them will be of fire-clay. Clay is the most plentiful building material on the face of the earth, and so cheap that it is not necessary to look for anything cheaper. One great advantage it has over solid concretes made of hydraulic cements so much used in Europe is that it can be made so much lighter. The clay must be of the refractory kind, that is, it must be either a plastic fire-clay, a semi-fire-clay, or a fire-clay mixed with a plastic clay or shale. The best fire-clays in their natural state are too "short" for this purpose and too brittle if highly burned. In the manufacture of porous terra-cotta very few clays have been found that are both practicable for making a good article and reliable to resist fire when in use. The places where the best have been found are Brazil, Indiana, Chaska, Minnesota, and several districts in Eastern New Jersey. For the manufacturer of hard fire-clay material good clay can be found in many localities. The best are the eastern clay belt of Ohio and the Panhandle of West Virginia; Utica and Ottawa, Ill., St. Louis, Mo., and near Lincoln, Cal. They are all white or buff clays, the buff clays being preferable on account of their toughness. No clay that burns red or salmon color is fit for a fire-proof building material. The greatest error of American architects has been in the acceptance of so called fire-proof materials made of inferior clays.

FIRE-PROOFING FLOOR OPENINGS.

(*Continued from page 165.*)

Over each door and transom window is placed a wooden box of some design and molding. In this box is a rolling steel shutter which travels in a groove in the jamb of the door. This box is so arranged that it forms part of the general design of the door or window frame, and apparently conceals the use for which it is intended. Back of this box, extending down both sides of the door or window, between the trim and the frame studding, is placed sheet iron in strips well fastened to the studding. At night these shutters are pulled down over doors and windows, effectively closing each floor from communication with the hallway, thus shutting off the other floors in case of fire in that one.

The scheme of shutters over internal openings is not particularly new, but the fact of concealing them so that their unsightliness may not be a part of the general finish is at least unusual. Of course this has not the general advantage of an absolutely fire-proof door, window, and shaft. Yet if a guarantee is given that such openings are closed at night, it is quite natural to suppose that this would be an effective cut-off for any fire, as long as was necessary to gain control over it.

Oliver H. P. LaFarge.

Mortars and Concrete Department.

Devoted to Advanced Methods of using Cements and Limes in Building Construction.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING. (*Continued.*)

THE specifications covering the use of cement on the new Croton aqueduct for New York City, and drawn by the chief engineer, Benj. S. Church, 1884, were as follows: —

"The greater part of the masonry is to be laid in American cement mortar, but Portland cement is to be used whenever directed.

"The American cement must be equal in quality to the best Rosendale cement; it must be made by manufacturers of established reputation; must be fresh and very fine ground, and in well-made casks.

"The Portland cement must be of a brand equal in quality to the best English Portland cement.

"To insure its good quality, all the cement furnished by the contractor will be subject to inspection and rigorous tests; and if found of improper quality will be branded, and must be immediately removed from the work; the character of the tests to be determined by the engineer.

"The contractor shall at all times keep in store, at some convenient point in the vicinity of the work, a sufficient quantity of cement to allow ample time for the tests to be made without delay to the work of construction.

"The engineer shall be notified at once of each delivery of cement. It shall be stored in a tight building, and each cask must be raised several inches above the ground by blocking or otherwise."

The tests employed on the line of the aqueduct were those recommended by the American Society of Civil Engineers, which are herewith given.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

REPORT OF THE COMMITTEE ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.

Presented at the Annual Meeting, Jan. 21, 1885.

To the American Society of Civil Engineers: —

Your Committee, appointed to devise a uniform system for tests of hydraulic cement, has the honor to submit this final report. Those portions of the preliminary report presented at the Annual Meeting held Jan. 16, 1884, which are not embodied herein, are superseded.

A uniform system of testing cement, in order to be practical, must be simple, rapid, and easy of application, and should, of course, be reasonably accurate. Between the very careful tests of the laboratory, which consume much time and involve considerable expense, and the rough and unsatisfactory trials often resorted to from necessity, there is a middle ground, which it has been the endeavor of the committee to occupy. The system proposed is by no means a perfect one — such has not yet been discovered — but it is hoped that it will be useful in eliminating many of the inaccuracies of the usual methods, and by making the system uniform, enable the experiments of the various members of the profession, in different parts of the country, and others interested in the subject of cement testing, to be satisfactorily compared.

The testing of cement is not so simple a process as it is sometimes thought to be. No small degree of experience is necessary before one can manipulate the materials so as to obtain even approximately accurate results.

The first test of inexperienced, though intelligent and careful persons, are usually very contradictory and inaccurate, and no amount of experience can eliminate the variations introduced by the personal equations of the most conscientious observers. Many things, apparently of minor importance, exert such a marked influence upon the results, that it is only by the greatest care in every particular, aided by experience and intelligence, that trustworthy tests can be made.

The test for tensile strength on a sectional area of one square inch is recommended, because, all things considered, it seems best for general use. In the small briquette there is less danger of air bubbles, the amount of material to be handled is smaller, and the machine for breaking may be lighter and less costly.

The tensile test, if properly made, is a good, though not a perfect indication of the value of a cement. The time requisite for making this test, whether applied to either the natural* or the Portland cements, is considerable (at least seven days, if a reasonably reliable indication is to be obtained), and as work is usually carried on, is frequently impracticable. For this reason short time tests are allowable in cases of necessity, though the most that can be done in such testing is to determine if the brand of cement is of its average quality. It is believed, however, that if a neat cement stands the one-day tensile test, and the tests for checking and for fineness, its safety for use will be sufficiently indicated in the case of a brand of good reputation; for, it being proved to be of average quality, it is fair to suppose that its subsequent condition will be what former experiments, to which it owes its reputation, indicate that it should be. It cannot be said that a new and untried cement will by the same tests be proved to be satisfactory; only a series of tests for a considerable period, and with a full dose of sand, will show the full value of any cement; and it would be safer to use a trustworthy brand, without applying any tests whatever, than to accept a new article which had been tested only as neat cement and for but one day.

The test for compressive strength is a very valuadle one in point of fact, but the appliances for crushing are usually somewhat cumbersome and expensive, so much so that it seems undesirable that both tests should be embodied in a uniform method proposed for general adoption. Where great interests are at stake, however, and large contracts for cement depend on the decision of an engineer as to quality, both tests should be used if the requisite appliances for making them are within reach. After the tensile strength has been obtained, the ends of the broken briquettes, reduced to one-inch cubes by grinding and rubbing, should be used to obtain the compressive strength.

The adhesive test being in a large measure variable and uncertain, and, therefore, untrustworthy, is not recommended.

FINENESS.

The strength of a cement depends greatly upon the fineness to which it is ground, especially when mixed with a large dose of sand. It is, therefore, recommended that the test be made with cement that has passed through a No. 100 sieve (10,000 meshes to the square inch), made of No. 40 wire, Stubbs's wire gauge. The results thus obtained will indicate the grade which the cement can attain, under the condition that it is finely ground, but it does not show whether or not a given cement offered for sale shall be accepted and used. The determination of this question requires that the tests should also be applied to the cement as found in the market. Its quality may be so high that it will stand the tests even if very coarse and granular, and, on the other hand, it may be so low that no amount of pulverization can redeem it. In other words, fineness is no sure indication of the value of a cement, although all cements are improved by fine grinding. Cement of the better grades is now usually ground so fine that only from 5 to 10 per cent. is rejected by a sieve of 2,500 meshes per square inch, and it has been so fine that only from 3 to 10 per cent. is rejected by a sieve of 32,000 meshes per square inch. The finer the cement, if otherwise good, the larger dose of sand it will take, and the greater its value.

CHECKING OR CRACKING.

The test for checking or cracking is an important one, and, though simple, should never be omitted. It is as follows:—

Make two cakes of neat cement 2 or 3 ins. in diameter, about ½ in. thick, with thin edges. Note the time in minutes that these cakes, when mixed with water to the consistency of a stiff plastic mortar, take to set hard enough to stand the wire test recommended by General Gilmore, $\frac{1}{12}$ in. diameter wire loaded with ¼ of a lb., and $\frac{1}{24}$ in. loaded with 1 lb. One of these cakes, when hard enough, should be put in water, and examined from day to day to see if it becomes contorted, or if cracks show themselves at the edges, such contortions or cracks indicating that the cement is unfit for use at that time. In some cases the tendency to crack, if caused by the presence of too much unslacked lime, will disappear with age. The remaining cake should be kept in the air and its color observed, which for a good cement should be uniform throughout, yellowish blotches indicating a poor quality; the Portland cements being of a bluish gray, and the natural cements being light or dark, according to the character of the rock of which they are made. The color of the cements when left in the air indicates the quality much better than when they are put in water.

TESTS RECOMMENDED.

It is recommended that tests for hydraulic cement be confined to methods for determining fineness, liability to checking or cracking, and tensile strength; and for the latter, for tests of seven days and upward, that a mixture of 1 part of cement to 1 part of sand for natural cements, and 3 parts of sand for Portland cements, be used, in addition to trials of the neat cement. The quantities used in the mixture should be determined by weight.

The tests should be applied to the cements as offered for sale. If satisfactory results are obtained with a full dose of sand, the trials need go no further. If not, the coarser particles should first be excluded by using a No. 100 sieve, in order to determine approximately the grade the cement would take if ground fine, for fineness is always attainable, while inherent merit may not be.

MIXING, ETC.

The proportions of cement, sand, and water should be carefully determined by weight, the sand and cement mixed dry, and all the water added at once. The mixing must be rapid and thorough, and the mortar, which should be stiff and plastic, should be firmly pressed into the molds with the trowel, without ramming, and struck off level; the molds in each instance, while being charged and manipulated, to be laid directly on glass, slate, or some other non-absorbent material. The molding must be completed before incipient setting begins. As soon as the briquettes are hard enough to bear it, they should be taken from the molds and be kept covered with a damp cloth until they are immersed. For the sake of uniformity, the briquettes, both of neat cement and those containing sand, should be immersed in water at the end of twenty-four hours, except in the case of one-day tests.

Ordinary fresh, clean water, having a temperature between 60 and 70 degrees F., should be used for the water of mixture and immersion of samples.

The proportion of water required varies with the fineness, age, or other conditions of the cement, and the temperature of the air, but is approximately as follows:—

For briquettes of neat cement: Portland, about 25 per cent.; natural, about 30 per cent.

For briquettes of 1 part cement, 1 part sand; about 15 per cent. of total weight of sand and cement.

For briquettes of 1 part cement, 3 parts sand; about 12 per cent. of total weight of sand and cement.

The object is to produce the plasticity of rather stiff plasterer's mortar.

An average of five briquettes may be made for each test, only those breaking at the smallest section to be taken. The briquettes should always be put in the testing machine and broken immediately after being taken out of the water, and the temperature of the briquettes and of the testing room should be constant between 60 and 70 degrees F.

The stress should be applied to each briquette at a uniform rate of about 400 lbs. per minute, starting each time at 0. With a weak mixture one half the speed is recommended.

WEIGHT.

The relation of the weight of cement to its tensile strength is an uncertain one. In practical work, if used alone, it is of little value as a test, while in connection with the other tests recommended it is unnecessary, except when the relative bulk of equal weights of cement is desired.

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* Where the word "natural" is used in this connection, it is to be understood as being applied to the lightly burned natural American or foreign cements, in contradistinction to the more heavily burned Portland cement, either natural or artificial.

We recommend that the cubic foot be substituted for the bushel as the standard unit, whenever it is thought best to use this test.

SETTING.

The rapidity with which a cement sets or loses its plasticity furnishes no indication of its ultimate strength. It simply shows its initial hydraulic activity.

For purposes of nomenclature, the various cements may be divided arbitrarily into two classes, namely: quick-setting, or those that set in less than half an hour; and slow-setting, or those requiring half an hour or more to set. The cement must be adapted to the work required, as no one cement is equally good for all purposes. In submarine work a quick-setting cement is often imperatively demanded, and no other will answer, while for work above the water-line less hydraulic activity will usually be preferred. Each individual case demands special treatment. The slow-setting natural elements should not become warm while setting, but the quick-setting ones may, to a moderate extent, within the degree producing cracks. Cracks in Portland cement indicate too much carbonate of lime, and in the Vicat cements too much lime in the original mixture.

NOTE.— Your committee thinks it useful to insert here a table showing the average minimum and maximum tensile strength per square inch which some good cements have attained when tested under the conditions specified elsewhere in this report. Within the limits given in the following table, the value of a cement varies closely with the tensile strength when tested with the full dose of sand.

American natural cement, neat: —

1 day, 1 hour or until set in air, the rest of the 24 hours in water, from 40 lbs. to 80 lbs.

1 week, 1 day in air, 6 days in water, from 60 lbs. to 100 lbs.

1 month (28 days), 1 day in air, 27 days in water, from 100 lbs. to 150 lbs.

1 year, 1 day in air, the remainder in water, from 300 lbs. to 400 lbs.

American and foreign Portland cements, neat: —

1 day, 1 hour, or until set, in air, the rest of the 24 hours in water, from 100 lbs. to 140 lbs.

1 week, 1 day in air, 6 days in water, from 250 lbs. to 550 lbs.

1 month (28 days), 1 day in air, 27 days in water, from 350 lbs. to 700 lbs.

1 year, 1 day in air, the remainder in water, from 450 lbs. to 800 lbs.

American natural cement, 1 part of cement to 1 part of sand: —

1 week, 1 day in air, 6 days in water, from 30 lbs. to 50 lbs.

1 month (28 days), 1 day in air, 27 days in water, from 50 lbs. to 80 lbs.

1 year, 1 day in air, the remainder in water, from 200 lbs. to 300 lbs.

American and foreign Portland cements, 1 part of cement to 3 parts of sand: —

1 week, 1 day in air, 6 days in water, from 80 lbs. to 125 lbs.

1 month (28 days), 1 day in air, 27 days in water, from 100 lbs. to 200 lbs.

1 year, 1 day in air, the remainder in water, from 200 lbs to 350 lbs.

Standards of minimum fineness and tensile strength for Portland cement, as given below, have been adopted in some foreign countries.

In Germany, by Berlin Society of Architects, Society of Manufacturers of Bricks, Lime, and Cement, Society of Contractors, and Society of German Cement Makers.

STANDARD OF 1877.

Fineness, not more than 25 per cent. to be left on sieve of 5,806 meshes per square inch.

Tensile strength, 1 part cement, 3 parts sand, 1 day in air, 27 days in water, 113.78 lbs. per square inch.

STANDARD OF 1878.

Fineness, not more than 20 per cent. to be left on sieve, as above.

Tensile strength, same mixture and time as above, 142.23 lbs. per square inch.

In Austria, by Austrian Association of Engineers and Architects.

STANDARD OF 1878.

Fineness, same as German of 1878.

Tensile strength, same mixture as above, 7 days, 1 day in air, 6 days in water, 113.78 lbs. per square inch.

28 days, 1 day in air, 27 days in water, 170.68 lbs. per square inch.

In Austria a standard for the minimum fineness and tensile strength of Roman cement was established and generally accepted, as follows: —

STANDARD OF 1878.

Fineness, same as Portland.

Tensile strength (1 part of cement, 3 parts of sand), for

Quick setting cement (taking 15 minutes or less to set): —

7 days, 1 day in air, 6 days in water, 23 lbs. per square inch.

28 days, 1 day in air, 27 days in water, 56.9 lbs. per square inch.

Slow setting cement (taking more than 15 minutes to set): —

7 days, 1 day in air, 6 days in water, 42.6 lbs. per square inch.

28 days, 1 day in air, 27 days in water, 85.3 lbs. per square inch.

The Roman cements correspond to those classified in this report under the head of natural cements.

Standards have been adopted also in Sweden and Russia.

SAMPLING.

There is no uniformity of practise among engineers as to the sampling of the cement to be tested, some testing every tenth barrel, others every fifth, and others still every barrel delivered. Usually, where cement has a good reputation, and is used in large masses, such as concrete in heavy foundations, or in the backing or hearting of thick walls, the testing of every fifth barrel seems to be sufficient; but in very important work, where the strength of each barrel may in a great measure determine the strength of that portion of the work where it is used, or in the thin walls of sewers, etc., etc., every barrel should be tested, one briquette being made from it.

In selecting cement for experimental purposes, take the samples from the interior of the original packages, at sufficient depth to insure a fair exponent of the quality, and store the same in tightly closed receptacles impervious to light or dampness until required for manipulation, when each sample of cement should be so thoroughly mixed, by sifting or otherwise, that it shall be uniform in character throughout its mass.

SIEVES.

For ascertaining the fineness of cement it will be convenient to use three sieves, viz.: —

No. 50 (2,500 meshes to the square inch), wire to be of No. 35 Stubbs's wire gauge.

No. 74 (5,476 meshes to the square inch), wire to be of No. 37 Stubbs's wire gauge.

No. 100 (10,000 meshes to the square inch), wire to be of No. 40 Stubbs's wire gauge.

The object is to determine by weight the percentage of each sample that is rejected by these sieves, with a view not only of furnishing the means of comparison between tests made of different cements by different observers, but indicating to the manufacturer the capacity of his cement for improvement in a direction always and easily within his reach. As already suggested in another connection, the tests for tensile strength should be applied to the cement as offered in the market, as well as to that portion of it which passes the No. 100 sieve.

For sand, two sieves are recommended, viz.: —

No. 20 (400 meshes to the square inch), wire to be of No. 28 Stubbs's wire gauge.

No. 30 (900 meshes to the square inch), wire to be of No. 31 Stubbs's wire gauge.

These sieves can be furnished in sets as follows, an arrangement having been made with a manufacturer of such articles, by which he agrees to furnish them of the best quality of brass wire cloth, set in metal frames, the cloth to be as true to count as it is possible to make it, and the wire to be of the required gauge. Each set will be enclosed in a box, the sieves being nested.

Set A, three cement sieves, to cost $4.80.

No. 100	7 ins. diameter.
No. 74	6½ ,, ,,
No. 50	6 ,, ,,

Set B, two sand sieves, to cost $4.

No. 30	8 ins. diameter.
No. 20	7½ ,, ,,

STANDARD SAND.

The question of a standard sand seems one of great importance, for it has been found that sands looking alike and sifted through the same sieves give results varying within rather wide limits.

The material that seems likely to give the best results is the crushed quartz used in the manufacture of sandpaper. It is a commercial product, made in large quantities and of standard grades, and can be furnished of a fairly uniform quality. It is clean and sharp, and although the present price is somewhat excessive (3 cents per pound), it is believed that it can be furnished in quantity for about $5 per barrel of 300 lbs. As it would be used for test only, for purposes of comparison with the local sands, and with tests of different cements, not much of it would be required. The price of the German standard sand is about $1.25 per 112 lbs., but the article being washed river sand is probably inferior to crushed quartz. Crushed granite could be furnished at a somewhat less rate than quartz, and crushed trap for about the same as granite, but no satisfactory estimate has been obtained for either of these.

The use of crushed quartz is recommended by your committee, the degree of fineness to be such that it will all pass a No. 20 sieve and be caught on a No. 30 sieve. Of the regular grade, from 15 to 37 per cent. of crushed quartz No. 3 passes a No. 30 sieve, and none of it passes a No. 50 sieve. As at present furnished, it would need resifting to bring it to the standard size, but if there were sufficient demand to warrant it, it could undoubtedly be furnished of the size of grain required at little, if any, extra expense.

A bed of uniform, clean sand of the proper size of grain has not been found, and it is believed that to wash, dry, and sift any of the available sands would so greatly increase its cost that the product would not be much cheaper than the crushed quartz, and would be much inferior to it in sharpness and uniform hardness of particles.

MOLDS.

The molds furnished are usually of iron or brass, the price of the former being $2, and of the latter $3 each. Wooden molds, if well oiled to prevent their absorbing water, answer a good purpose for temporary use, but speedily become unfit for accurate work. A cheap, durable, accurate, and non-corrodible mold is much to be desired, but is not yet upon the market. Plates Nos. XLIV. and XLV. show the form of briquette and of metal mold recommended. It may be added that your committee are not in entire accord with respect to the merits of this form of briquette, its principal defect being that the rupture must take place at the neck or smallest section, whether the strain be one of extension only or otherwise. With a briquette of such form that oblique strains would usually produce rupture in oblique directions, the trials taking this character would be rejected, and the accuracy of the results correspondingly increased thereby.

CLIPS.

In using the clips recommended in the preliminary report, it was found in some instances that the specimens were broken at one of the points where they were held. This was undoubtedly caused by the insufficient surface of the clip, which, forming a blunt point, forced out the material. Where the specimens were sufficiently soft to allow this point to be imbedded, they broke at the smallest section, but when hard enough to resist such imbedding they showed a wedge-shaped fracture at the clips. To remedy this the point should be slightly flattened so as to allow of more metal surface in contact with the briquette. Clips made in this way have been used, and good results obtained.

To adapt the 1 in. clips of the Riehle machine only a slight amount of work is necessary; the ends being rounded, as shown in Plate No. XLVI., will admit the proposed new form of briquette, and yet not prevent the use of the old one, thus allowing comparative tests of the two forms to be made without changing the clips.

There should be a strengthening rib upon the outside of the clips, as shown in Plate No. XLVI., to prevent them from bending or breaking when the specimens are very strong.

The clips should be hung on pivots, so as to avoid, as much as possible, cross strain upon the briquettes.

MACHINES.

No special machine has been recommended, as those in common use are of good form for accurate work, if properly used, though in some cases they are needlessly strong and expensive. Machines with spring balances are to be avoided, as more liable to error than others.

It is by no means certain that there exists any great difference in well made machines of the standard forms given.

The experiments of the committee do not seem to justify an expression of preference for any one machine. Plates Nos. XLVII. and XLVIII. show three American machines, with the prices obtained from the manufacturers.

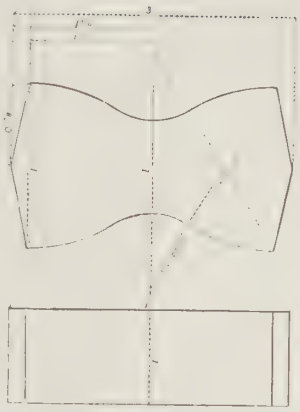
AMOUNT OF MATERIAL.

The amount of material needed for making five briquettes of the standard size recommended is, for the neat cements, about 1⅔ lbs., and for those with sand, in the proportion of 3 parts of sand to 1 of cement, about 1¼ lbs. of sand, and 6⅔ ozs. of cement.

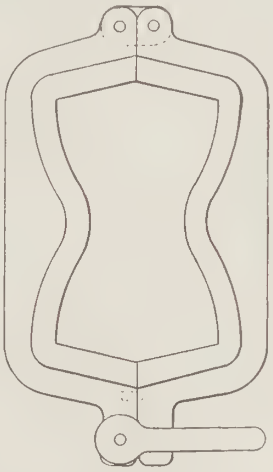
All of which is respectively submitted.

Q. A. GILLMORE,
Chairman.

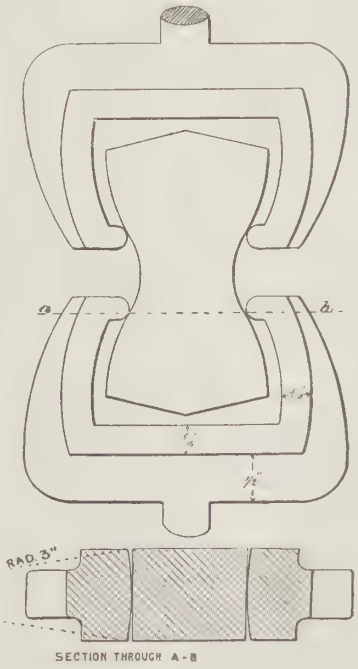
D. J. WHITTEMORE.
J. HERBERT SHEDD.
ELIOT C. CLARKE.
ALFRED NOBLE.
F. O. NORTON.
W. W. MACLAY.
LEONARD F. BECKWITH
THOS. C. McCOLLOM.



DETAILS FOR BRIQUETTE.
Reduced to half size.
PLATE XLIV.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.



STANDARD FORM FOR MOLD.
Reduced to half size.
PLATE XLV.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.



STANDARD FORM FOR BRIQUETTE AND CLIPS.
Reduced to half size.
PLATE XLVI.
TRANSACTION AMERICAN SOCIETY CIVIL ENGINEERS. VOL. XIV. NO. 315.
REPORT ON A UNIFORM SYSTEM FOR TESTS OF CEMENT.

The Masons' Department.

Conducted in the Interests of the Mason and the Contractor for Brickwork.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

BUILDING CONTRACTS.

THE consideration of this subject opens a field which is, practically, inexhaustible, and the treatment of it in these columns must necessarily be confined to a brief summary of the most important points involved, but it is hoped by this means to show the necessity of a more complete and thorough understanding of the matter on the part of both architects and contractors, particularly the latter. While the architect, if his education has been thorough, may have a certain amount of theoretical and superficial knowledge bearing on this important branch of his professional duties, the contractor's information on such a matter is, from force of circumstances, somewhat limited. At the present time a large proportion of our most successful builders are men who actually started at the bottom of the ladder, first serving their time as apprentices, then as journeymen, and finally, by their superior ability and enterprise, rising to be foremen, and master builders. No training could be better than this to make a man competent to handle successfully the practical problems of the building trade, but at the same time it must be admitted that such training affords little opportunity or incentive for the consideration of what might be called the semi-legal side of the business of the contractor. But because a thorough understanding of this matter is so rarely found among architects and contractors, it is no reason why the matter should be overlooked; for while in work of any unusual magnitude it is always best to have the benefit of legal advice, it is a comparatively simple matter to master the principles involved in ordinary and every-day transactions, at least, so far as to know when it may be necessary to call in a professional adviser. There is a somewhat prevalent notion that a contract is something which cannot be understood or interpreted, much less executed, except by lawyers or men of superior intelligence. This idea is erroneous, for there is no need, in framing a contract, to use any terms which cannot be readily understood by any one having a common school education; in fact, if the words or language are obscure, there is good reason to believe the document is faulty and should not be executed without a careful and critical examination. The proper time to interpret a contract is before it is signed, not after it has been brought into court. It should be understood, however, that certain legal phrases which perhaps to an inexperienced person may seem incomprehensible have an advantage in having been used for so long a time that their exact meaning has been established both by usage and decisions by the courts, but such facts make it a simple matter, when one meets with such phrases, to determine exactly what their true meaning is.

It is important at the outset to call attention to the fact that while "the law does not seek to compel a man to do that which he cannot possibly perform," it does not protect him if he chooses to contract to do that which is impossible. In other words, if the court is called upon to interpret something which is implied in a contract, it will not compel a man to do that which is impossible; but if, on the other hand, a man fairly agrees to do something which proves to be impossible, he is the victim of his own folly, and cannot escape responsibility or damages. If the court makes the law, it is merciful; if it is to enforce a law which has been made for it, it is relentless and even cruel.

The importance of having for all building work a legally drawn contract in which the requirements on both sides are clearly set forth cannot be over-estimated. If the parties to such an agreement are honest, a document of this kind will tend to prevent disagreements and lawsuits, for honest people are usually willing to live up to their promises; while, on the other hand, if one or more of the parties concerned for some reason resort to the courts, a clear and valid contract will go a great way toward obtaining a just and equitable settlement.

There is an important point in connection with building contracts to which attention should be called, and which is often overlooked by the contractor, which is, that the general conditions which usually precede the specifications as well as the drawings are virtually a part of the contract, and as a matter of fact often carry greater obligations than many of the requirements of the contract itself. If the architect is inclined to resort to sharp practise, it is comparatively easy for him to introduce in some inconspicuous place in the general conditions demands upon contractor, which, if they have not been considered by him, may prove of serious consequence. It is, therefore, most important that the contractor, when figuring a piece of work, should read carefully all written or printed matter accompanying a set of drawings. This caution would seem unnecessary were it not for a fact that it is a common occurrence to see a contractor, particularly a sub-contractor, turn hurriedly over the pages of general conditions, which are likely to contain conditions of vital importance, without reading a single paragraph. It seems hardly necessary to call attention to the fact that the general contractor should make all sub-contracts dependent on the same conditions under which he is placed, but experience shows that this precaution is frequently overlooked.

In work of any magnitude, it is only fair that before handing in his estimate the contractor should know the conditions under which the work is to be carried on. Instances are constantly occurring where, after a bid has been accepted, the contractor is confronted by a contract which contains requirements he had no reason to believe he would be called upon to fulfil, and this method is often unjustly used to prevent the lowest bidder from receiving the work. The best and fairest way to overcome this difficulty is to have the proposal contract, general conditions, and bond, if one is to be required, printed with the specifications, which gives the contractor the opportunity to consider at one time all the obligations under which he will be required to execute the work, providing his proposal is accepted.

Before considering the matter in detail it is important to define the legal requirements of contracts in general. "A contract is an agreement between two or more persons to do or abstain from doing some definite thing or things." And its conditions may be divided into two classes, express or implied. In the first instance the terms are expressed, either in writing or verbally, at the time the agreement is made; in the second, as the terms are implied they are defined by law.

Expressed contracts may, therefore, be again divided into verbal and written agreements. The verbal contract is limited by the so-called statute of frauds to "work which is performed within one year from the making thereof," and as this restriction should limit the work done under this form to comparatively small and unimportant undertakings, it is unnecessary to consider it further than to call attention to the fact that this limitation exists and is good law, and that the elements of a verbal (or simple contract, as it is sometimes called) are the request, the consideration, and the promise. That is to say, there must be a request on the part of the employer that the work be done, or, if he accepts the benefit of the work, the request will be implied. But a request without a consideration being void, there must be something of value, however small, given by the employer to the employee, or there is no obligation on the part of the latter.

A written contract shows on its face the obligations it carries, and the conditions therein set forth will be interpreted and enforced by the courts without being qualified by oral testimony, which is rarely admitted for the purpose of qualifying a written agreement, provided the claim of fraud is not introduced. It matters not what was the intention if it does not conform to the terms of the document. There is this distinction, even in written contracts, which should be noted. A written contract which is not sealed must have a consideration named, but if a seal is affixed the consideration may be omitted, such being the result of ancient legal fiction, which it is unnecessary to discuss here. But the seal has a further significance, for in England, and to some extent in this country, a contract with a corporation is not valid unless the signature of its legal representative is accompanied by the official seal. Although the seal is not always essential, it is of vital importance that a contractor, before concluding an agreement with a corporation, should be absolutely sure of two things. First, that the document has the signature of the legal representative of the contracting body; second, that the terms of the contract do not exceed the powers of the corporation. For instance, if a contract which is legally drawn in all other particulars calls for an expenditure of money in excess of that which a corporation or board was authorized to spend, in all ordinary cases the contractor has no claim beyond the sum authorized.

An implied contract is of such indefinite character that a concise definition of it can hardly be framed. A good example of an agreement of this class would be where a person sees work of which he accepts the benefit being done, on premises owned by him; in such a case an obligation on his part to pay for such work would be implied. It should be understood that the laws of the different States vary more or less in regard to contracts, as in all other legal matters, but the examples and conditions cited above are, as a general rule, universally accepted as good law. It is the intention in the following paper to consider in detail the different requirements of a building contract and define the obligations which each one carries, so far as they have been determined by the courts.

THE INDIVIDUAL RESPONSIBILITY OF THE CONTRACTOR.

BY D. B. GARNSEY.

IN considering those conditions by which the building contractor is surrounded, which obstruct the direct and profitable transaction of his business, the fact must be recognized that the contractor himself has become so imbued with the belief that individual interests are paramount to all others, and, except in remote degree, have no distinct relation to the interest of the community, that he fails to understand that his welfare and business success rest upon the conditions of the community, for which he is responsible.

The ability to profitably transact his business depends as much upon the conditions existing in the community in which that business is transacted as it does upon the individual efforts of the contractor; and his responsibility for the conditions prevailing in the community exist in exact ratio with his responsibility to his individual welfare. If the builder were isolated from the community — entirely independent — it is self-evident that his field of operation would be limited, and his range of success restricted; but being dependent upon his relation to and connection with the community, it is upon the fulfilment of the obligations thus entailed that his prosperity is based.

Being a factor in the community, it is imperative that the contractor perform the functions of his part with such fidelity to the justice of his every relationship that it will be impossible for him to be dealt with unjustly by any other part.

If the contractor fails to perform his part and his methods are unfair, it is manifest that he draws to himself others whose dealings are of a similar character, and therein becomes responsible for the perpetuation of damaging conditions in the community, and demonstrates that upon the individual depends the welfare of the whole.

The contractor has been so long in the habit of yielding point after point to those with whom his business is transacted, in order to obtain his contracts, that he fails to understand that each concession has given to the person to whom the concession was made a disproportionate share of the benefits of the relationship. Knowing that the contractor has been sufficiently unjust to his competitors to warrant the assumption, the person to whom concessions have been made has come to demand these concessions as a right, because experience has taught him that he has but to demand and the contractor will yield.

There is nothing illogical in the existence of damaging conditions in the building business, for they are the direct outgrowth of the lack-method system by which the business is generally conducted. There being virtually no legal control of methods of competition, the transaction of the building business upon a fair and honorable basis depends upon the sense of justice and moral obligation of those by whom it is transacted. Continued concession by the contractor of what he believes to be his rights results in blunting the sense of moral obligations that exists in business, and lowers the standard upon which the business is conducted. The effect upon those immediately concerned in building, of the abrogation of his rights by the individual, is to weaken the resisting power of all contractors in the community, and to increase their damage from the cupidity of the individual. The presence of these causes is clearly shown in the fact that contractors are perpetually complaining that competition (?) is conducted in a majority of cases under conditions so void of equity that profitable business is virtually an impossibility. Fair and honorable competition has been so diverted from its natural purposes by the illegitimate action of individuals that owners or architects having work to let may demand anything they wish from the contractor with almost a certainty of its being conceded. It is under such conditions as these, which are the direct outgrowth of ignorance and unscrupulousness, that contract after contract is let at prices and under requirements which seem prohibitive of profit to the contractor; and it is only fair to assume that contracts taken under such conditions must be fulfilled either at a loss to the contractor, or by such unfair practises as will enable him to make a profit.

Reputable contractors are continually being astonished at the prices for which work is taken, the variation between the highest and lowest bids being frequently as great as one third of the total cost of the work.

The cause of this state of affairs is self-evident, for the act of giving away his rights, by the contractor, affects every individual cumulatively, and therefore the community, until a point of depression is reached where profit is impossible, under existing methods of competition.

The integrity of the contracting business is disturbed by the practises of those whose greatest interest is the maintenance of that integrity. When one contractor unjustly yields a point or cuts a price, in order to secure a contract, his competitor is forced, in self-protection, to do the same; and these increasing concessions and increasing cuts in price react upon each other until the whole community of contractors is made to suffer from the effects of the cupidity of the individual.

The failure of the contractor to fulfil his responsibilities, and to protect himself, and therefore the community, against the inevitable damage of such courses is the primal cause of the chaotic condition of the competitive part of the building business.

Very elastic customs to the contrary notwithstanding, the contractor has no right to damage himself by unfair concessions, or by submitting to unjust requirements in order to obtain his contracts; for, being a part of the community, and in a measure dependent upon it, when he damages himself he damages every other member of the community. Generally stated, the contractor is solely to be blamed for the onerous conditions prevailing in his business, of which he complains; for constant submission invites continued and increasingly iniquitous requirements. To submit to unjust requirements is tantamount to an admission that such requirements are just.

Contractors must protect themselves from their competitors and from others before the conditions in the community will ever become protective; and it is self-evident that there is no protection in making the same concessions that the incapable and unscrupulous are compelled to make in order to secure work,

Recent Brick and Terra-Cotta Work in American Cities.

A Department Devoted to the Interests of the Manufacturer.

BUFFALO. — The Ellicott Square, with its ten stories of imposing Italian Renaissance, has taken front rank as one of the notable features of this city, and, occupying one entire square, may justly be called the largest, finest, and most complete office building in America.

The building derives its name from Joseph Ellicott, formerly agent of the Holland Land Company, who laid out the village of New Amsterdam, now Buffalo, and owned this square upon which the building now stands.

The building measures 204 by 200 ft., and 144 ft. high. It may be classified as a small town having a community of four to five thousand persons, while the building is said to be visited by no less than fifty thousand persons daily.

The building possesses many advantages and accommodations not found in smaller structures, whereby a tenant may obtain the highest degree of personal comfort and unsurpassed facilities for the prompt transaction of business.

Under the same roof can be found good banking accommodations, legal, architectural, and engineering advice, medical aid, dental service, life, accident, marine, and fire insurance, Turkish, Russian, and plain baths; cigars, newspapers, periodicals, stationery, postage stamps, a luxurious café, a more economical lunch counter, two very complete barber shops, and a law and reference library with librarian in charge.

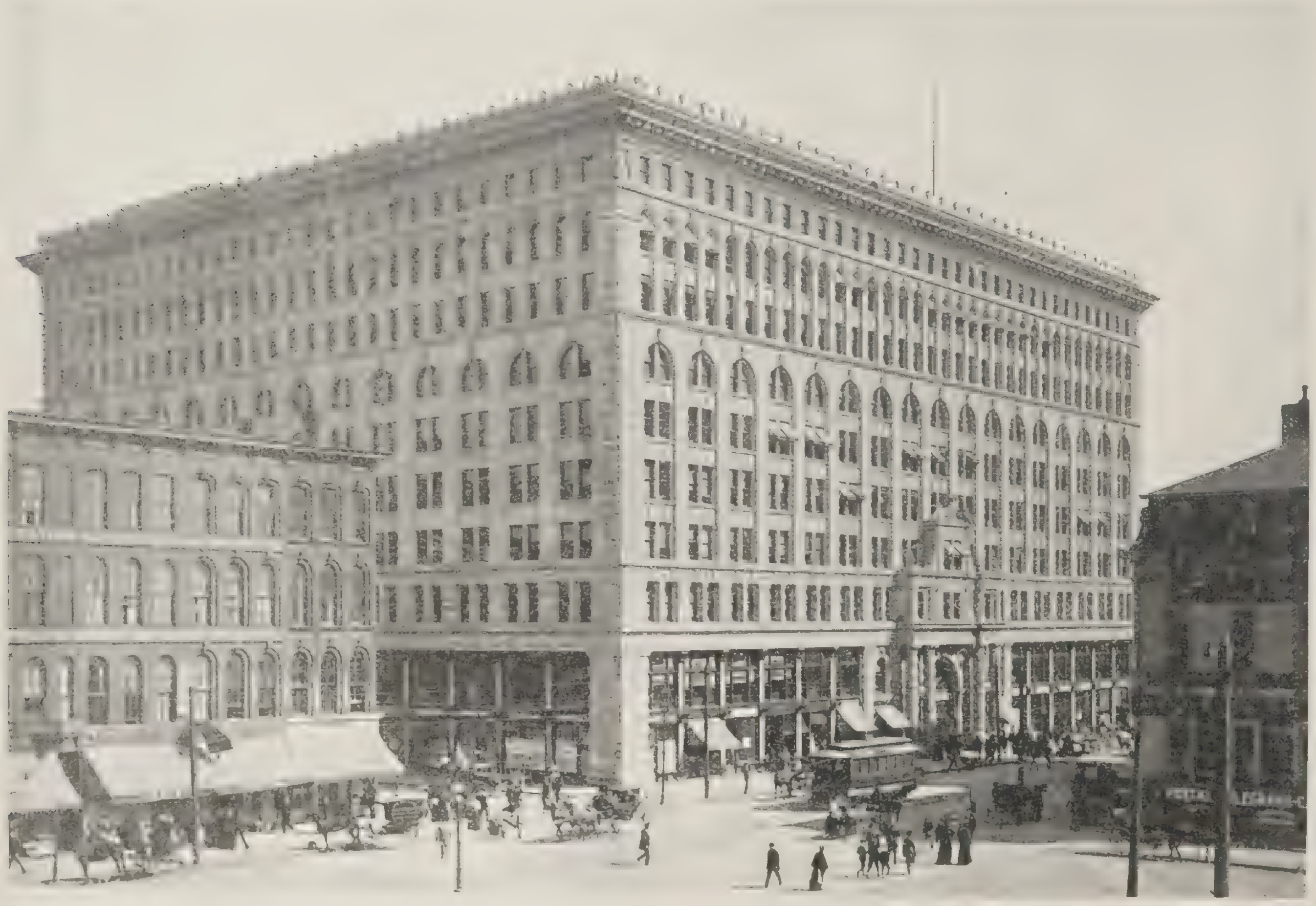
The first floor has 16 ft. ceilings, being divided into forty stores devoted to diversified lines; the second floor has 14 ft. ceilings, and contains sixteen banks or counting rooms; the seven floors above are arranged into six hundred offices or studios, having telephone, messenger calls, wardrobes, marble wash-basins, and in every other office a vault, while in the halls are mailing chutes.

The tenth floor is divided between the Ellicott Club, organized by business men, and the general offices of the Western Union Telegraph Company.

In the center of the building is a large court, 110 by 70 ft. wide, with two grand stairways leading up to a balcony which encircles the court at level of banking floor, and having bronze railings of very pleasing designs.

The court is covered at the third story with opaque glass, providing abundance of light through the day, and illumined by two grand electroliers at night.

The vestibules are two stories high, joining the court at either side; both are faced with Italian marble, with floors of marble mosaic.



ELLICOTT SQUARE BUILDING, BUFFALO, N. Y.
D. H. Burnham & Co., Architects.

Architects of building, D. H. Burnham & Co.; general contractors, Jonathan Clark & Sons Co.

The exterior is treated in pearly gray brick with courses, entrance, and cornice of same colored terra-cotta, furnished by Perth Amboy Terra-Cotta Company.

Frame, steel; weight, 5,500 tons; Carnegie.

Fire-proofing, Pittsburg Terra-Cotta Company; 12,000 tons.

Foundations, steel and concrete, 19 ft. below grade, composed of six thousand barrels of Giant Portland Cement.

CHICAGO.— Quite a book might be written on the subject of "Signs in Relation to Commercial Architecture." When viewing the chaotic appearance of any part of the crowded business district, where signs of all sorts and sizes are seen in such confusion that no one of them is conspicuous, and good architectural design is completely hidden, one is forced to the conclusion that not enough consideration is given by designers of business buildings to the signs which necessarily must be displayed as soon as the building is occupied. Some of the later office buildings require their tenants to conform to certain rules, generally limiting them to display signs gilded on the glass. But for stores, shops, and factories, signs are usually an after-thought, whereas the architect ought to provide for them in such a manner that the building would not be disfigured by the advertising, even if he is not himself allowed to design the signs. Signs, by the way, as a study outside of any esthetic consideration, are quite a fad with some people. Some of the signs visible in Chicago are more appropriate than those of Mr. Waters and Mr. Coffee, who sell beer. A Mr. Hay keeps a feed store, Mr. Burns sells coal and wood, and Miss Wigfall has false hair for sale. One of the latest noticed by the writer is a 20 ft. sign on W. Madison Street,— "Babies reduced to $1.00 per dozen." There is no explanation except the character of the building, which indicates a photograph gallery within.

Labor Day, this year, saw a splendid parade of the union organizations. The estimated number of workingmen in line was twenty thousand, and it served as an impressive spectacle to remind the many thousand onlookers of the growing power of labor unions. The same motive dominates now that in ancient times led the silversmiths of Ephesus to mob Paul because he was interfering with the demand for silver Dianas. There is no record that anybody objected when Paul stopped preaching for a time and resumed his tent-making, but a Chicago preacher found himself brought up short a few days ago when he thought he would help build his own church, and temporarily resumed his old trade as a carpenter. The walking delegate ordered work stopped, and it did not go on until the minister left saw and hammer for his pastoral calls.

There are seven large buildings in Chicago in process of construction (all of which have been mentioned in this column previously), whose combined cost is estimated at $4,400,000. These keep building matters from seeming quite dead, but, nevertheless, the dulness is serious. The records show that the permits for buildings in August, 1896, were but little more than half those of August, 1895, whether measured by number, cost of buildings, or feet frontage.

The condition of the loan market has tied up many building projects.

Among the most important of minor buildings in progress are some fine residences designed by Wilson & Marshall.

Contracts have been let by Mr. Martin Carr for the erection of a $100,000 Catholic Church.

ST. LOUIS.— The Chemical Building on the corner of 8th and Olive Streets is rapidly nearing completion, and will soon be ready for occupancy. It contains no special features, other than those found in other first-class office buildings. It is seventeen stories high, in what Barr Ferre is pleased to call the degenerate Chicago style; its many angular bays and the numerous ornamental horizontal lines which mark the different stories suggest, to use a common expression, that the architect had found "a good thing," and was tempted to "push it along." He has left no quiet spot upon which we may rest the eye, and, although we may be awed by its great height, we find it lacks the impressive simplicity and imposing contour of its less pretentious neighbor, the Union Trust Building.

The architect has given us quite a surprise by the use of very dark red brick and terra-cotta, quite out of the ordinary in this day of lighter colors.

It is gratifying to see gray brick being employed more generally than heretofore with terra-cotta of the same color. There seems to be no better color, especially for down-town buildings, as it gives the appearance of solidity, and is defaced less by the smoke and dirt than any other color, and the excellent results obtained with it in residences in connection with lighter trimmings in stone or terra-cotta is being appreciated.

The Steifel Building, adjoining the Hagan Opera House on Pine Street, is also nearly completed. It is a six-story, fire-proof commercial building in which the gray brick have been used, but unfortunately, the full value of the color is not obtained on account of a light mortar having been used. The brick were furnished by the Hydraulic Press Brick Company of this city, and the terra-cotta by Evans & Howard.

The architect has not been very considerate with his style, for, although the general scheme of his façade is in the Renaissance, he has seen fit to decorate his window mullions with Gothic, while in the frieze he has paid tribute to Louis H. Sullivan by ornamenting his panels in such a manner as would be a credit to Mr. Sullivan himself.

Some few years ago one Mr. Fagin conceived the idea of putting up a building of an original design, and so well did he succeed that the building attracted attention far and near, if not for its beauty, at least for its striking originality, and a year or two ago it was severely criticized by the *Architectural Record*, under the head of "Architectural Aberrations." A few months ago the building was sold to the Burlington Building Company, who have remodeled the interior, making a first-class office building of it, and replaced the street front with a more consistent design in brick and terra-cotta. They have also renamed it the Burlington.

ENAMELED BRICK.

FOR exterior use in city architecture it would be difficult to name any material which combines more good qualities than enameled bricks. Durability, beauty, cleanliness are three important requisites, all of which are combined in the glazed bricks of best quality now being offered in this market. The Tiffany Pressed Brick Company, of Chicago, are making a very superior quality of enameled bricks, in which the enamel forms a complete and inseparable union with the body of the brick. The severest tests have proven that the enamel will stand for inside or outside work in any climate, and that it is practically indestructible by frost or heat. On the score of beauty these bricks are unexcelled. They are made in white, ivory, cream, buff, brown, chocolate, blue, green, granite, etc., and thus are readily adapted to any of the most elaborate schemes of ornamentation the architect may devise. Their shapes are also advantageous for this purpose, being of the English pattern, 9 by 3 by 4½ ins.; the American, 8¼ by 2¼ by 4 ins.; the Roman, 12 by 1½ by 4. In regular stock the company keep stretchers, quoins, octagon, round end, splay, and soaps. It can be readily understood that beautiful effects in fireplace, mantel, and chimney work may be produced with the various shapes and shades of these enameled bricks, and for outside work they offer endless possibilities in artistic combinations, which, with the aid of the architects' working plan, can be set by any experienced mason.

The consideration of cleanliness, especially in a city, is by no means of least importance. The grime which comes from years of contact with city soot is so repulsive that it is never creditable to architect or owner. There is just as much necessity for a building that "will wash" nowadays as for any other object of every-day use. Enameled brickwork, inside or out, is readily cleansed with the hose, if necessary, and when washed presents as good an appearance as when new.

As to quality, it is sufficient to say that the Tiffany enameled bricks are equal, if not superior, to the best of English manufacture. But the most remarkable item is the low cost at which they can be produced. It is said that they can successfully compete in price with plain terra-cotta. This important consideration should lead to their adoption for a great variety of uses. — *Inland Architect.*

FIRE IN THE OFFICE OF THE COLLIERY ENGINEER COMPANY, AT SCRANTON, PENN.

THE offices of the Colliery Engineer Company, proprietors of *The Colliery Engineer and Metal Miner*, *Home Study*, and the International Correspondence Schools, in the Coal Exchange Building, Scranton, Penn., were partially destroyed by fire on Sunday morning, August 30, 1896. Fortunately, the printing plant was in another building, and *The Colliery Engineer and Metal Miner* and *Home Study* will be delayed in publishing only a few days. The reserves of all instruction and question papers, drawing plates, and other supplies and stationery used in the schools were kept in another building; consequently there will be no delay in conducting the instruction in the schools. New quarters have been engaged in the Mears' Building, and everything is running as smoothly as though no fire had occurred.

WATCH THIS COLUMN FOR POINTERS.

THE POWHATAN CLAY MANUFACTURING COMPANY are supplying the brick for the new Princeton Library Building, Princeton, N. J.

WALDO BROTHERS are furnishing Hoffman Cement on the Boston & Albany Railroad work at Newton. About twenty-five thousand barrels will be used.

WALDO BROTHERS are furnishing Alsen Portland Cement on city work at Woonsocket, R. I., notwithstanding the fact that the price was the highest submitted.

THE "Brooklyn Bridge Brand" of Rosendale Hydraulic cement will be used in building the new Syndicate Building, on Park Row, opposite the Astor House, New York City. R. H. Robertson is the architect, Dorson & Archer, masons.

THE UNION AKRON CEMENT COMPANY, Buffalo, N. Y., are furnishing the cement for concrete and foundation for paving two streets in Gloversville, N. Y., and also for similar work at Detroit, Mich. Their cement is also being used in foundation and brickwork for two large school buildings at Salem, Ohio.

THE RALSTON BRICK COMPANY, Ralston, Penn., manufacturers of buff, mottled, and fancy brick in all shades and colors, report a business which taxes the entire capacity of their plant. The clay from which their bricks are made is of an exceptionally fine quality, and the company, alive to the demands of the better class of architects, is producing bricks that are in every way first class.

THE POWHATAN CLAY MANUFACTURING COMPANY'S cream-white bricks, Roman shape, are being supplied to D. M. Lea for nine residences on Kenesaw Avenue, Washington, and their standard size for a new residence at Somerville, Mass., Enrico Tassanari, Esq., owner. They are also furnishing forty thousand granite-colored bricks to J. E. Cox, Esq., for his new residence at High Point, North Carolina.

THE agency in New England for the "Puzzolan" brand of German cement, made by H. H. Meier & Co., has been placed with Waldo Brothers.

This cement is being used largely in connection with light limestone to avoid stains and discolorations. It was used on Edison Electric Light Company's Building at Atlantic Avenue, and is being used on all face work on the new Hotel Touraine, Boylston and Tremont Streets, Winslow & Wetherell, architects.

THE roofing tile made by the Celadon Terra-Cotta Company, Charles T. Harris, lessee, will be used on the following buildings now being erected: —

Residence for George Willard, Chicago, Postle Bros., architects. Residence for L. A. Carton, Chicago, W. A. Otis, architect. Residence for J. A. Cummings, Chicago, A. J. Hussander, architect. Residence for Mr. Erisman, Philadelphia, T. P. Lonsdale, architect. Coach house for Jacob Kaufmann, St. Louis, Link & Rosenheim, architects. Station for Erie Railway Company, Alfred, N. Y., G. E. Archer, architect. Holy Angels' Church, Chicago, J. J. Egan, architect.

THE Perth Amboy Terra-Cotta Company will furnish the architectural terra-cotta on the following buildings, now under construction: —

Sprague residence courtyard, Brookline, Mass., Little, Brown & Moore, architects. Apartment house, 308 East 121st Street, New York, Schneider & Herter, architects. Residence at York, Pennsylvania, J. A. Dempwolf, architect. Stewart Building, Dorchester, Mass., L. C. Greenleaf, architect. Newton Bank, Newton, Mass. Wm. Gibbons Preston, architect. Residence for G. W. Childs Drexel, Bryn Mawr, Penn., Peabody & Stearns, architects. St. John's Home for Boys, Brooklyn, N. Y., R. L. Daus, architect. Forney School, Harrisburg, Penn., Miller & Kast, architects. Salvage Corps Station No. 2, Brooklyn, N. Y., R. L. Daus, architect.

THE TIFFANY PRESSED BRICK COMPANY, Chicago, are furnishing the enameled brick which is being used in the following buildings: —

Illinois Central Suburban Depot, lake front, Chicago, Ill., Francis T. Bacon, architect. Pennsylvania Railroad Depot, Columbus, O., D. H. Burnham & Co., architects. Stewart Building, northwest corner Washington and State Streets, Chicago, Ill., D. H. Burnham & Co., architects. Auburn State's Prison, Auburn, N. Y. Fourth Precinct Police Station, Cleveland, O., Wm. W. Sabin, architect. Washburn Memorial Home, Minneapolis, Minn. E. Smeeth Estate Building, Chicago, Ill., enameled brick for front, D. E. & O. H. Postle, architects. Toledo & Ann Arbor Railroad Depot, Toledo, O., W. T. Cooper, architect.

THE MARSH METALLIC CORNER BEAD is fast recommending itself to general use as a reliable and efficient corner-plate, which supplies ample clinching spaces for the mortar to bend around the corner and unite the two sides of the plastering. This bead consists of a rod of steel held rigidly at any required distance from the corner to be protected. Longitudinal depressions on the sides receive the mortar and furnish a grip for a metallic holder or clip. They also give the plaster a substantial thickness to its extreme edge and prevent the crumbling incident to a feather edge. As all parts are galvanized, this bead can be used with artificial plasters as well as with lime mortar. The corner when finished presents a smooth, rounded surface for paper or decoration. Different forms of clip enable this bead to be used as readily on the corners of brick and terra-cotta partition walls and of fire-proof construction as on wood studding.

THE "Columbus Brick" made by the Columbus Brick and Terra-Cotta Company, Union Furnace, Ohio, have been specified in the following buildings now under construction: —

Library Building, Princeton University, Princeton, N. J. (Gray Roman), W. A. Potter, New York, architect. Flats and stores for Wm. B. Hamilton, Lenox Avenue and 115th Street, New York (Gray Roman), Neville & Bagge, New York, architects. The Westinghouse "Club House," Wilmerding, Penn. (Gray Roman). The Yerkes Observatory for Chicago University, Williams Bay, Wis. (Gray Roman), Henry Ives Cobb, Chicago, architect. The Wattles Residence and barn, Omaha, Neb. (Gray Roman), Walker & Kimball, Omaha, architects. Dormitory for Smith's College, Northampton, Mass. (Dark Buff Normans), Scott & Edelsvard, New York, architects. Union Congregational Church, Worcester, Mass. (Dark Buff Roman), Earle & Fisher, architects. Flats and stores for John Flanagan & Son, Amsterdam Avenue and 110th Street, New York (Terra-Cotta Roman), G. A. Shellenger, architect. The Hartford Life and Annuity Building, Hartford, Conn. (Light Buff Standard), F. R. Comstock, architect. Government Building, Rock Island, Ill.

(Terra-Cotta Standard). The Secor Building, Toledo, O. (Light Gray Standard), E. O. Fallis & Co., Toledo, architects. The Coghlin Building, Toledo, O. (Light Gray Standard), David L. Stine, architect. St. Francis Church, Columbus, O. (Rock-Faced Gray Standard), Yost & Packard, Columbus, architects. Central Ohio Paper Company's Building, Columbus, O. (Gray Standard), H. A. Linthwaite, architect. Residence for W. G. Bush, Nashville, Tenn. (Light Buff Standard). Ninth Avenue Public School Building, Columbus, O. (Gray Standard), David Riebel, architect. Residence for J. C. Treadwell, Kingston, N. Y. (Gray Roman), A. F. Mason, architect. The "Garrett," Toledo (Speckled Brick).

CONSOLIDATION OF TWO IMMENSE CONCERNS.

WE would announce to our readers the consolidation of the two clay-working machinery manufacturing concerns heretofore known as The Frey-Sheckler Company, of Bucyrus, Ohio, and J. W. Penfield & Son, of Willoughby, Ohio. This has been accomplished by the formation of a new corporation, namely, the American Clay-Working Machinery Company, with a capital stock of $600,000. To this new corporation has been sold the machinery manufacturing plants, patterns, patents, and good-will of both concerns, both of whom thus virtually retire from the machinery manufacturing business. The arrangement is not in any sense a pool or trust; on the contrary, the sale and conveyance of the two plants is absolute and the new company will hereafter be vested with the entire properties and good-will of both the old ones. The objects leading to this change in form of organization were to set into operation superior methods and greater facilities for producing and marketing the highest grade of clay-working machinery with the greatest economy of time, effort, and expense, thereby making it possible to place upon the market a superior quality of machinery at the lowest price consistent with good workmanship, and yet secure a safe margin of profit. Furthermore, there was liability of expensive and annoying litigation between the two concerns, which is, of course, obviated by the new arrangement. The officers of the company are as follows: President, J. W. Penfield; First Vice-President, R. C. Penfield; Second Vice-President, C. W. Fisher; Secretary, W. W. Reehl; Treasurer, J. B. Gormly; General Manager, W. C. Lemert. The general offices of the company will be located at Bucyrus, Ohio. The several departments of the two companies will be merged and the list of machinery produced will comprise all of the lines formerly made by the individual concerns. By this consolidation of interests, there is formed one of the largest, most valuable, and best equipped enterprises of the kind in the world, both as to personnel, manufacturing facilities, and equipments, patents owned and controlled, and variety of clay-working machines and appliances produced.

The new firm states that the prices of machinery will not be advanced, but as above indicated, competition will be met by improved methods of manufacturing and selling the goods, and by the consequent greater economy in cost thus made possible, as well as by the excellence in quality of the goods produced. The lines of machinery produced by the new firm embrace nearly every conceivable form of clay-manipulating appliances, which, together with the company's resources and facilities, will enable it to fully equip any clay-working establishment, whether large or small, with a complete and perfect outfit entirely suited to its requirements, and at a reasonable price. It will be the policy of the new company to leave no stone unturned to keep fully abreast of the times in every respect, and to continue to be in a position to fully anticipate and meet the requirements of the trade, both by the quality and price of its goods and by its methods of dealing.

All correspondence with reference to new machinery or relating to the business of the new company should be addressed to the American Clay Working Machinery Company, Bucyrus, Ohio. For the present, however, correspondence with reference to repairs for machinery originally shipped from Willoughby should be addressed to the American Clay Working Machinery Company, Willoughby, Ohio. Correspondence relating to repairs for machinery originally shipped from Bucyrus should be addressed to the general offices at that place. The clay-testing department of the company is located at Bucyrus, and all clays to be tested should be forwarded to that point. All unfilled contracts for machinery or goods will be executed by the old concerns.

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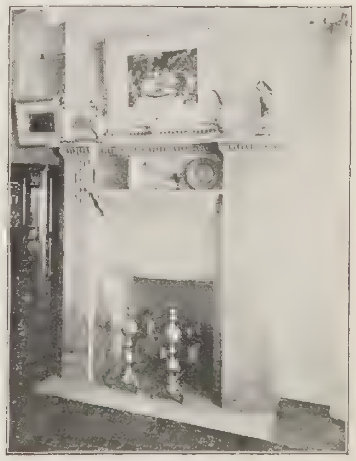

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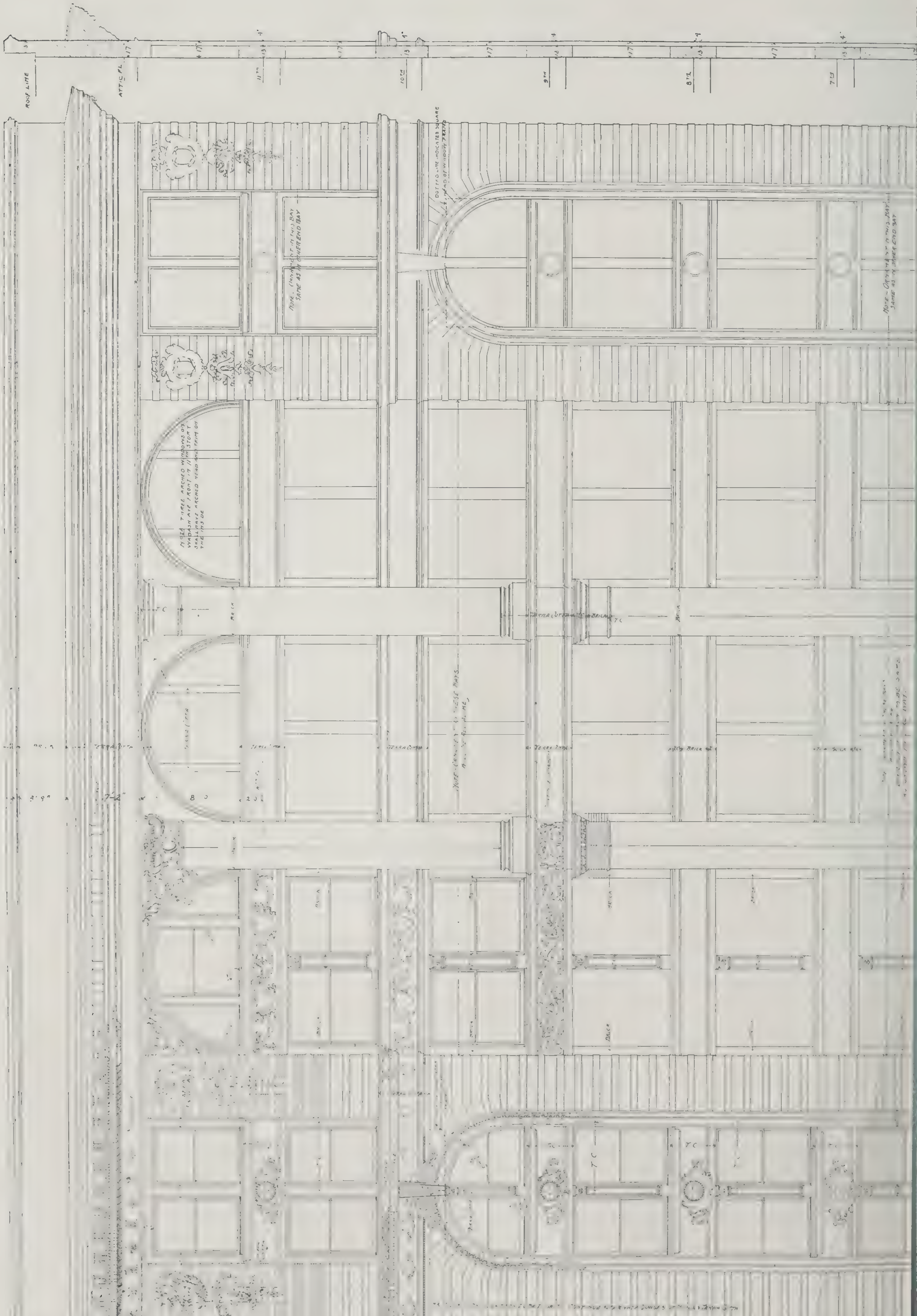
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NOTE. ORNAMENT IN THIS BAY SAME AS IN OTHER END BAY
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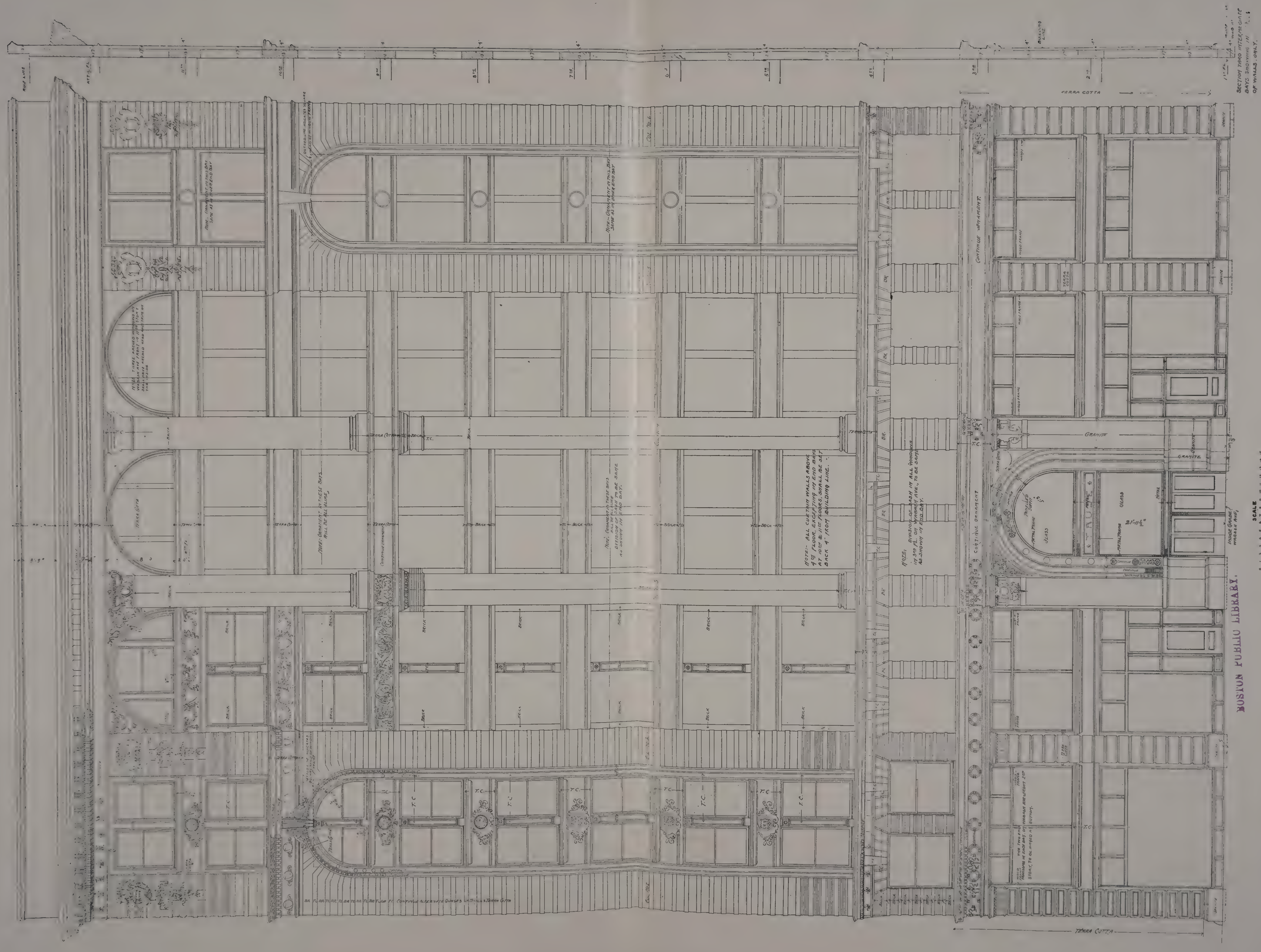
BRICK
T.C.
TERRA COTTA



TRUDE BUILDING, CHICAGO.—WABASH AVENUE ELEVATION.

JENNEY & MUNDIE, ARCHITECTS.

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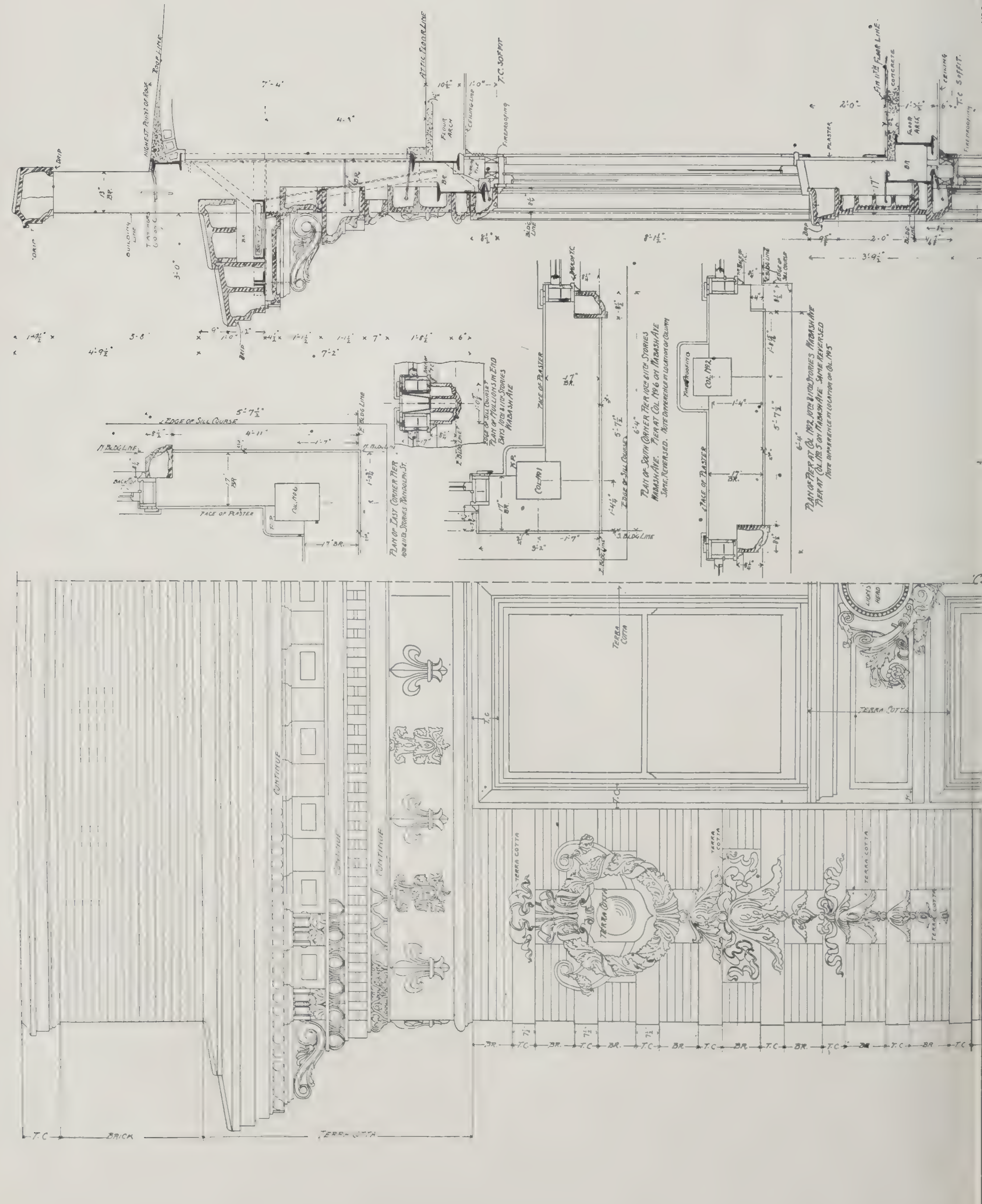
ROOF LINE
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ATTIC FLOOR LINE
T.C. SOFFIT
FIREPROOFING
CEILING LINE
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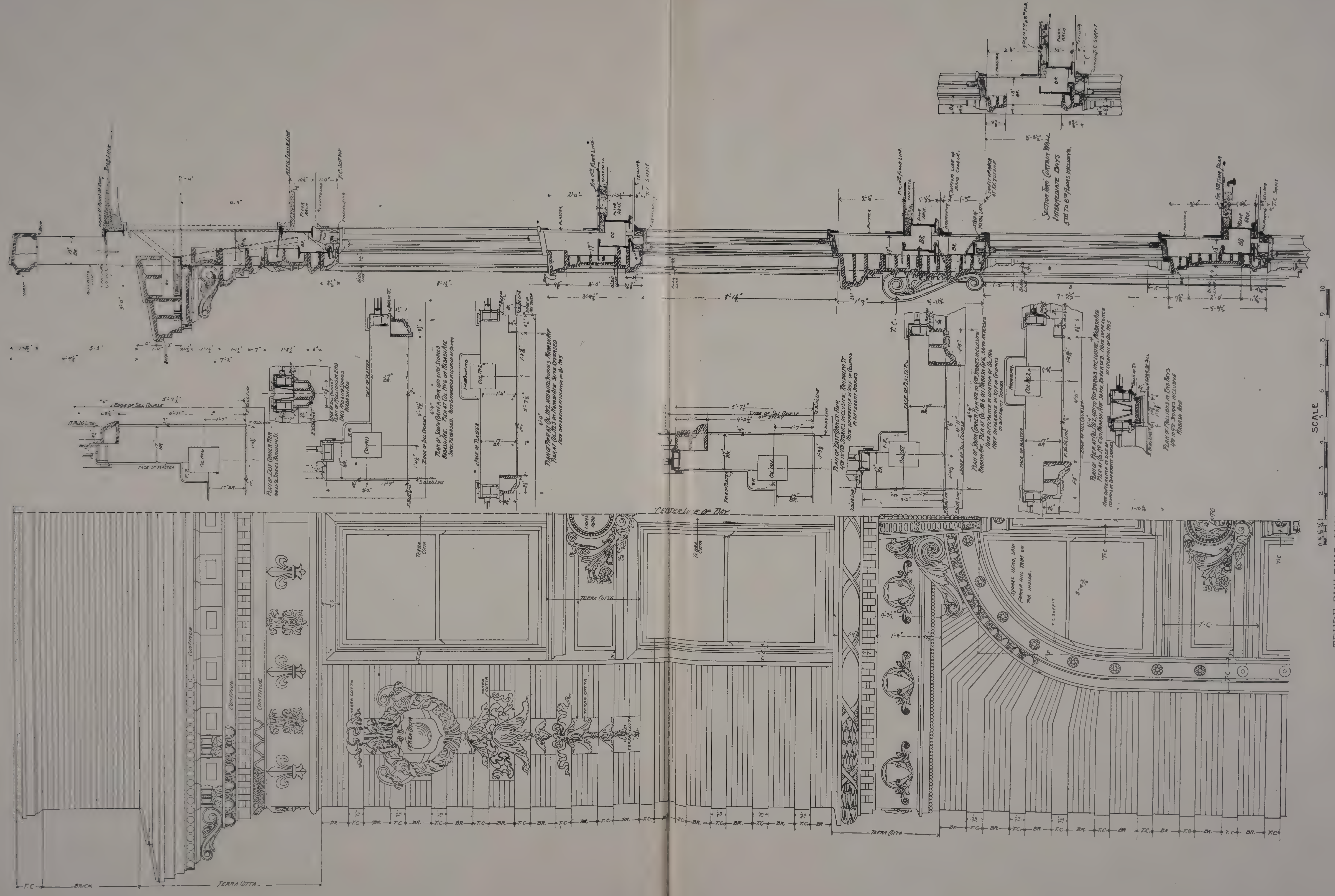

TRUDE BUILDING, CHICAGO.—HALF ELEVATION OF SOUTH END BAY, UPPER THREE STORIES—WABASH AVENUE FRONT.

JENNEY & MUNDIE, ARCHITECTS.

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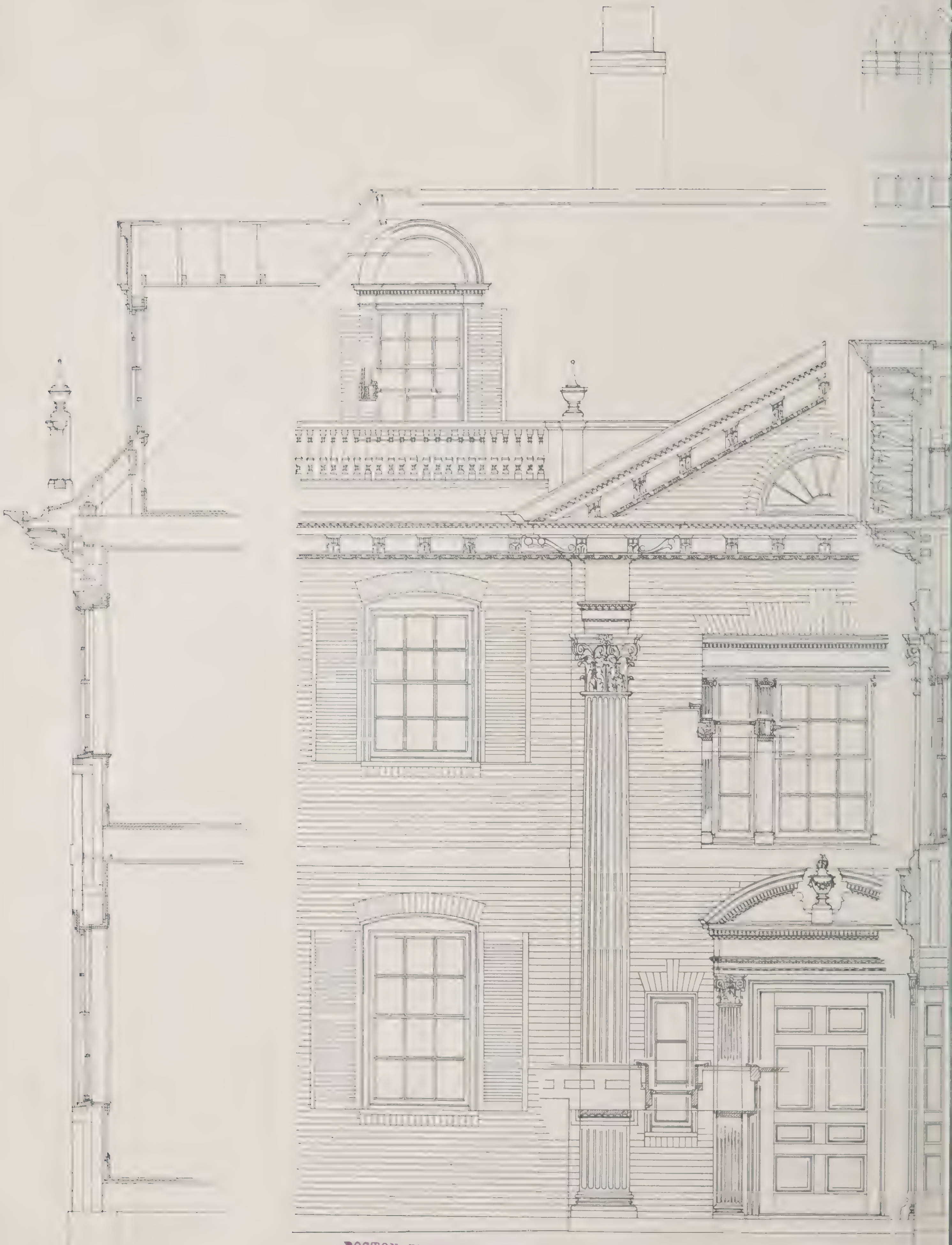

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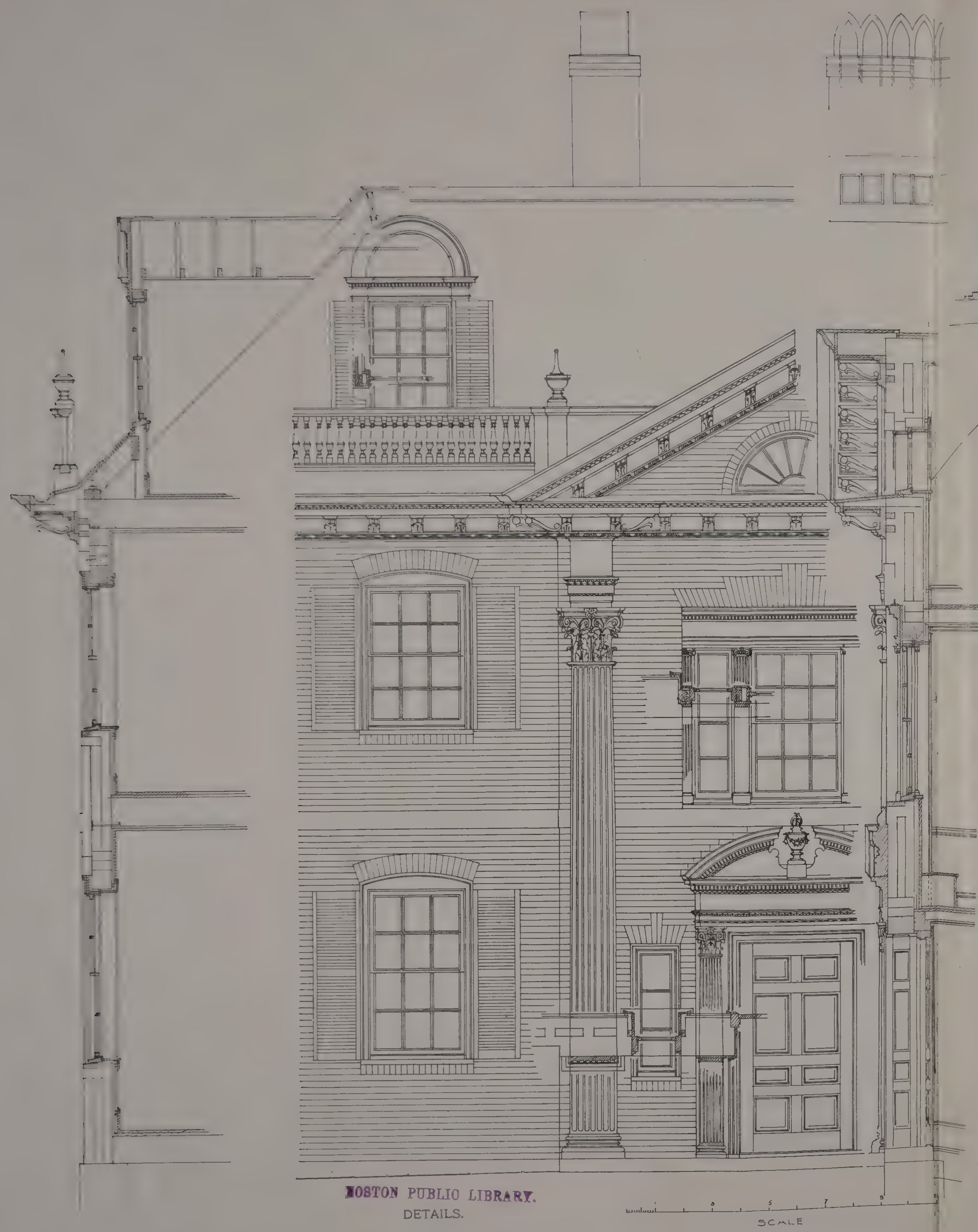
DETAILS.

BRICK RESIDENCE FOR MRS. JO
R. CLIPSTON



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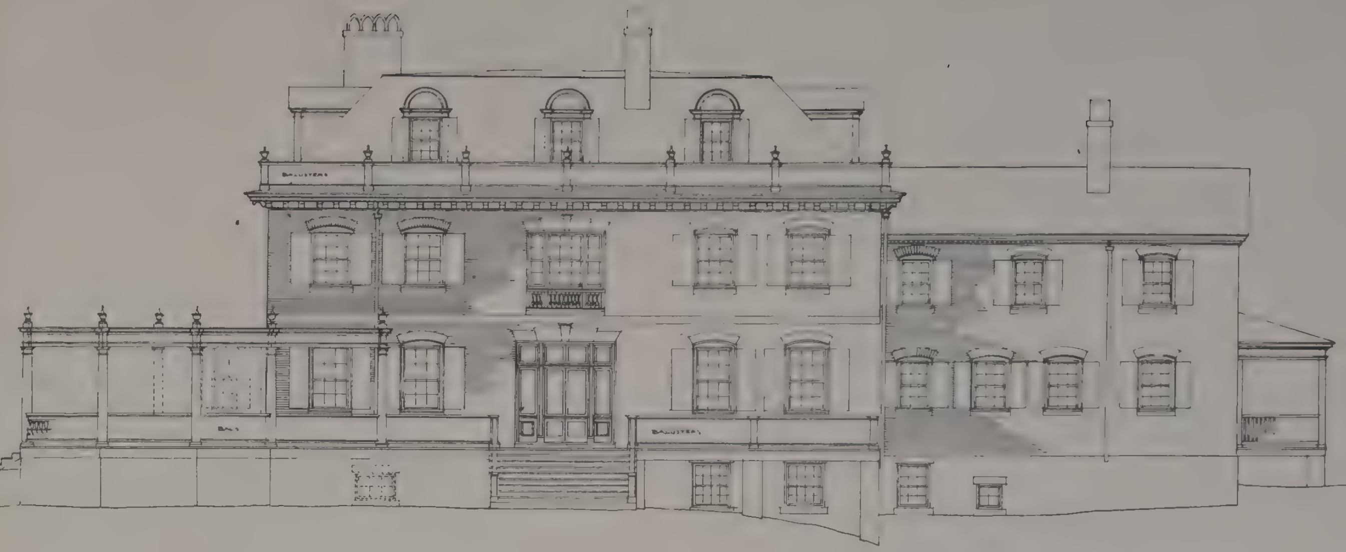
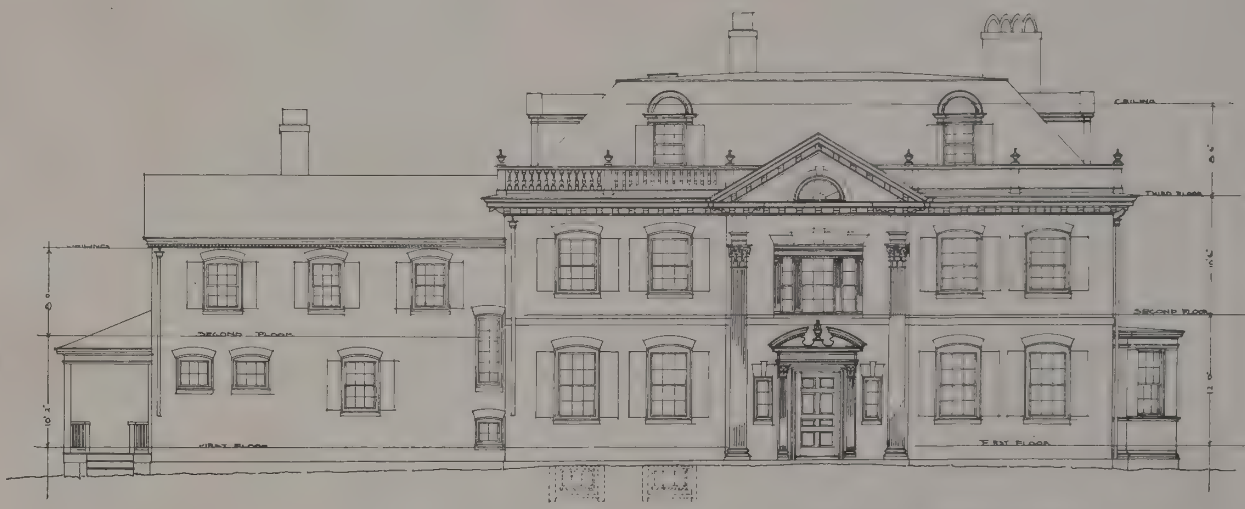
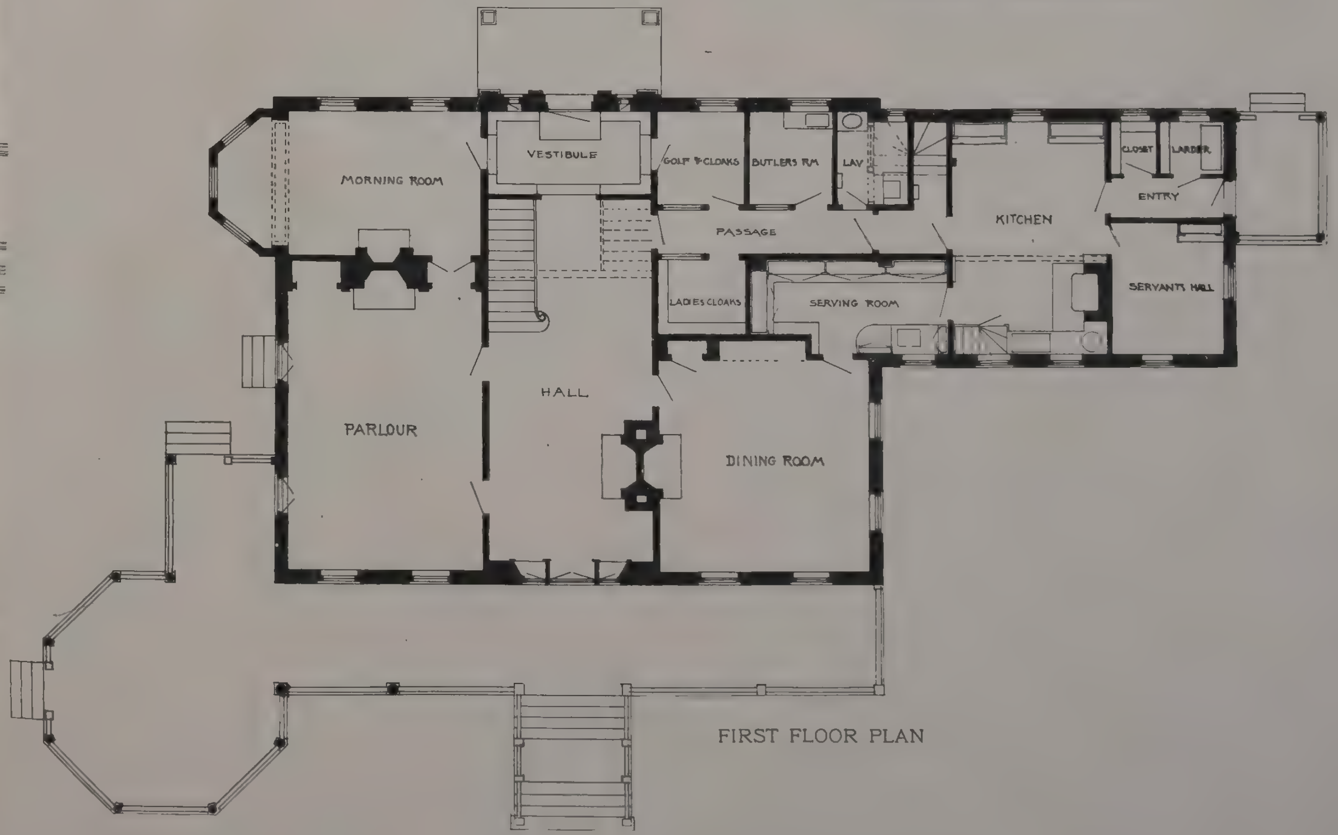


ELEVATION TOWARD SEA.



ELEVATION TOWARD ROAD.



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BRICK RESIDENCE FOR MRS. JOHN H. STURGIS, MANCHESTER, MASS.

R. CLIPSTON STURGIS, Architect.

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

Cushing Building, 85 Water Street, Boston.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

The Brickbuilder is published the 20th of each month.

STYLE.

THE editorial in our September number, considering the subject of imitations in building material, drew attention to the essential characteristics which should distinguish terra-cotta from stone work. The nice observance of these distinctions and their application to executed work form a very considerable element in the indeterminate quantity which goes to make up what is termed "style" in architectural design, and which in its broader artistic sense constitutes the intrinsic merit of a composition and marks the vital character which we would wish to have associated with the work at its best. Style may be not inappropriately defined as the mark of the essential moral character and conscious creative rectitude evinced by the artist in his work. In this respect it is entirely distinct from fashion or usage. The Parthenon possesses real style; the works of the Della Robbias are full of it; and no one can study the beauty of a Greek antefix or one of Botticelli's paintings without being keenly conscious of a quality running through both, similar in spirit though totally different in manifestation, a sense of innate refinement and of conscious purity which we designate as the style. Now style is something that is often wofully lacking in our modern work. With our retrospective habits, our tricks of borrowing lavishly from all of our artistic ancestors, and our opportunities for mechanical production, it is very easy to lose the touch, the sentiment, which would elevate our work to the dignity of an art as distinguished from a mere science or manufacture. Our stone architecture and our woodwork we can copy line for line, and can set up photographs before our mechanics, and impart a very strong flavor of classic antiquity to our details, when both material and design are copied literally; but to give burnt clay the proper terra-cotta look, to produce ceramic work which shall be *sui generis*, we must infuse in our design the individuality of style which will stamp it properly and give it the right flavor.

Style does not always come by seeking; an appreciation for it is a matter of temperament as well as education, and all designers do not succeed in equal measure in imparting real style unto their productions. But while a talent for an art is rare, it is given to every one to cultivate the taste therefor, and in proportion as we strive to infuse a more genuine appreciative style into our work, to refine it, to make it true to the material and natural in its manifestations, just in that proportion will our art be enjoyable and the product be such as can rank with the best of the work of the past which we are now so eager to copy. The fact that terra-cotta is so truly the result of the personal manipulation of the artist, and that it receives so immediately the touch of the designer's hand, has been no inconsiderable factor in winning for it the acknowledged artistic position which it occupies to-day. There is no building material which catches the artistic inspiration so truly and retains it so happily as terra-cotta, and we are much more apt to find true style manifested in architectural design as represented by the burnt-clay industries than in a material which to be wrought in execution has to be laboriously cut, hammered, and carved into place, or worked over through the mangling operations of patterns, molds, and castings.

It is easier to illustrate manifestations of style than to exactly determine a quality which owes its existence to individual taste. In the latter part of the last century and the early part of the present, a number of brick country dwellings were erected in the neighborhood of the Potomac Valley, forming a group of manor houses which in their way have seldom been equaled, and never thus far excelled as examples of quiet, refined, domestic architecture. These throughout in their design and arrangement, as well as in their interior finish, possessed emphatically the *cachet* of good style. They were inspired very largely by the work of the preceding period in England, and were the outcome of the education and refinement which was so peculiar to the section of the country at that period in our history. Compare these simple, beautiful buildings with the ostentatious elaborations which mark the domestic brick architecture of the period immediately following the Civil War, when Swiss *châlets*, Italian villas with sanded fronts and pagoda-like towers, and four-inch brick veneered constructions applied over wooden boarding were considered in good taste. The dullest intellect cannot fail to appreciate that the Virginia homesteads possessed real intrinsic style, while the latter structures were utterly, hopelessly commonplace and vulgar. And coming to more recent times, compare the crude factory-like masses which have resulted from the attempts to build warehouses or factory buildings with the few isolated examples, such as the Boston Storage Warehouse, designed by Messrs. Chamberlin & Whidden. In both constructions the problem is identical, the material is the same, the cost not essentially different, but the difference in the results is as marked as that existing between the Virginia homes and the shoddy brick shanties of pre-centennial times. One is nothing but a simple mass of brick, unrelieved, and without an idea or suspicion of anything like thought, style, or dignity, while the other is as truly in good style and full of art impulse as the historic monuments of the past. H. H. Richardson used to say that it was one of his ambitions to build a big grain elevator. He would probably have added a brewery. In many respects these are among the most interesting problems of brick design, but as customarily treated they are hopelessly unsuccessful. No attempt is made to take advantage of the magnificent possibilities of wall surface, contour, and picturesque outline which each presents in so marked a degree. Some day a master hand will get at both these types and solve them in so striking a manner, with so marked a dash of style, spirit, and artistic conception, that we will wonder why such constructions were ever considered as necessarily hideous.

THE PASSING OF THE CARPENTER.

AN interesting chapter might be written upon the passing of the carpenter. The time was in this country when the function of the mason was limited to cellar work and plastering, with a few chimneys incidentally introduced in the framework, which was essentially carpenter work. It is only a few years since general contracting was almost entirely in the hands of carpenters, and the masons were sub-bidders. But we have changed all that with the extended use of brick, so that now in a thoroughly modern up-to-date, first-class building carpenter work is reduced to the barest minimun, and the most successful of our large general contractors are the masons rather than carpenters. In the best of our office buildings the only woodwork remaining is in the shape of window frames and sashes. We have iron doors and frames, terra-cotta or marble dadoes and bases, and solid masonry floors supported upon iron, and wooden finish of every description is sedulously eschewed. Even the window frames and sashes bid fair to be supplanted by constructions of metal. Fortunately for the carpenter, and also unfortunately for the insurance companies, the wooden residence is still with us, but we hope to see this type of building transformed, and even detached houses throughout our suburbs constructed in part, if not wholly, of brick and terra-cotta.

TWO EXTRA PLATES FOR OCTOBER, NOVEMBER, AND DECEMBER.

THE issues of THE BRICKBUILDER for the remaining months of the year will contain two extra plates.

By making this addition to our plate form, we are in hopes to publish most, if not all, of the drawings promised in our Prospectus for the year, very nearly all of which we now have in hand. Delays in the preparation of drawings for publication have been our chief obstacle, although a consistent effort has been made to not only carry out our program as announced, but to present to our subscribers selected drawings from the best offices in the country.

Should circumstances warrant, we shall continue the two extra plates during 1897.

Subscribers will confer a favor by not sending to us drawings for publication that have not been solicited, for the reason that we have already made arrangements for much of the work that we shall publish next year, and having made our plans in advance, we have been obliged to decline many interesting and excellent drawings for want of opportunity to publish.

CLUB NEWS.

CHICAGO ARCHITECTURAL CLUB. On Monday evening, September 28, Lucy Fitch Perkins discussed the "Artistic Possibilities of Chicago" before the members of the club.

In the call for the meeting it was stated that every member would be expected to be prepared to answer the question: What would you do to beautify Chicago?

The annual election of officers was held on Monday evening, October 5. Richard E. Schmidt was elected president, and Arthur G. Brown, secretary.

On Monday evening, October 12, the retiring officers, Messrs. Dean, Garden, Lilleskan, and Hunt, entertained the members of the club.

At the first regular meeting of the year 1896–97, held October 19, the lists were opened for classes in architecture, pen and ink, and water color.

The Eighth Annual Competition for the Robert Clark Testimonial, held under the auspices of the club, is announced.

The subject is,—

A BATH HOUSE FOR A SMALL CITY.

The building is to be placed in the City Park.

It shall not be more than 200 ft. in its greatest dimension.

It shall consist of one story and basement. The first story shall contain the following rooms: A large hall for conversation and the promenade; it may be lighted from above. Two lounging or reading-rooms, one for each sex. These rooms shall communicate with the bathing departments, each of which shall contain the following rooms: Plunge-room containing a basin of about 1,500 sq. ft. area,— it should be lighted from above; attendants' and checking-room; towel and suit-room; about fifty dressing-rooms; about ten bath-rooms; one toilet-room.

The competition is open to architectural draughtsmen under thirty years of age, residents of the United States, and not practising architects.

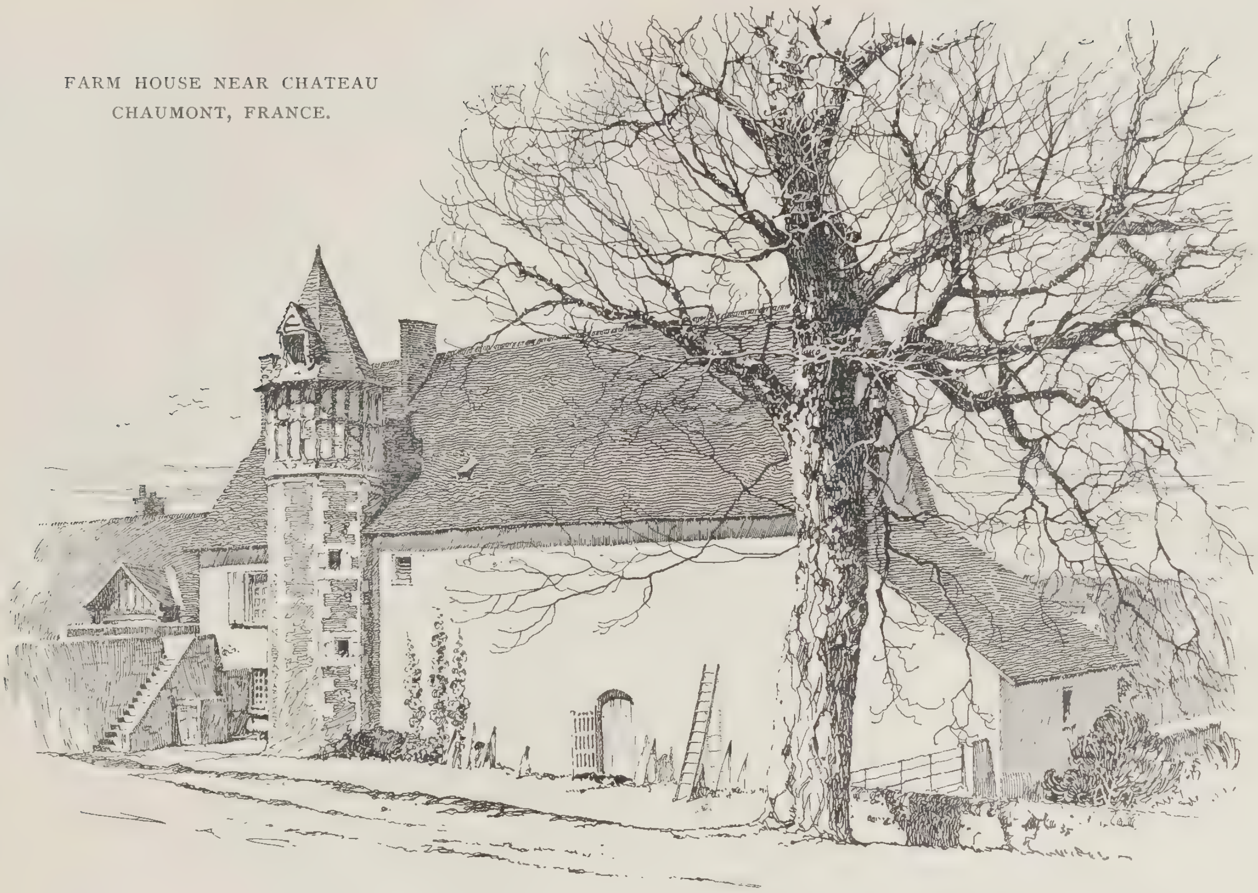
THE ST. LOUIS ARCHITECTURAL CLUB held its monthly meeting on Saturday evening, October 3, and after the routine business enjoyed lunch, which was provided by Messrs. Deitering, Farrish, and Dwyer. The club, at the September meeting, decided to enter upon the winter's work at once, and since that time the class in architecture, under Mr. A. Guissart, and the class in pen and ink, under Mr. Oscar Enders, has been meeting regularly on Thursday and Saturday evenings respectively, excepting that on Thursday evening, October 8, the members laid aside their T square to attend the wedding of one of its members, Mr. Ed. Marquardt.

Much more earnest enthusiasm is being manifested by the members than at any time within a couple of years, and the club is in a flourishing condition.

ILLUSTRATED ADVERTISEMENTS.

THE adjoining spandrel is one of four, all bearing various heraldic devices, and will be used between the first story arches of the Tremont Street elevation, on the Pavilion Building, Boston. There will be another front on Pemberton Square, in which terra-cotta is used extensively, but less elaborate in point of detail. Messrs. Burr & Sise, Beacon Street, Boston, are the architects, and the work is being executed by the New York Architectural Terra-Cotta Company.

The design shown in the company's advertisement for this month, on page xxviii, is the one submitted by Mr. D. C. Meyers, Williamsport, Penn., in the competition held by this company, and which took fourth prize.

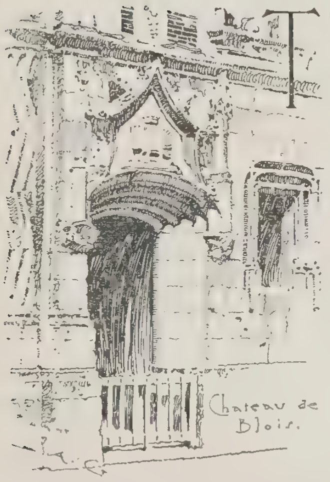


FARM HOUSE NEAR CHATEAU CHAUMONT, FRANCE.

Architectural Rendering in Pen and Ink.

BY D. A. GREGG.

PRINCIPALITY AND REPETITION.


Chateau de Blois.

To properly follow my previous article in The Brickbuilder, I should now give attention to shade and shadow, or values; but these we will put aside for the present and consider composition in one of its phases, principality, and repetition.

I will not dispute very seriously that with some the artistic sense may exist to such a degree that in pictorial composition they intuitively do the right thing every time. But that such minds operate totally without rule I quietly doubt. There may be an arrangement of words, but some standard of correctness exists which could be put into words if the happy possessor cared to do it.

Possibly I mistake in supposing that any one says there are men and women so gifted. But there is an impression in my mind that it is believed by some.

It can easily be understood how a young artistic mind would avoid the consideration of rules, and make no effort to look them up, dry, mechanical, distasteful things, of the same class as rules in mathematics. And truly a poor artist would he become, who, at the beginning, studied on that line instead of going direct to nature herself.

But study nature for awhile, a long while, and some day try a composition of your own. It will probably not be long before a conviction will unpleasantly creep over you that some of the difficulties met are not trifling, effects don't satisfactorily arrange, and you hail with delight anything, whatever name you may give it, that will straighten matters out.

In my acquaintance with artists I have had evidence enough times to convince me that all have ideas in composition, picked up somewhere, from a book or from a friend, or, better than either, from hard, thoughtful experience, that are invaluable in their work. These are their "stock in trade," best used by the possessor himself usually, because thoroughly thought out, tried and proved.

I remember with gratitude a Mr. Edward Wimbridge, in New York, a talented English artist, one of the first illustrators on stone, of the London *Building News*, with whom I fortunately became acquainted in my early draughtsman days.

More than once when struggling over a rendering I have gone to his house in the evening to get advice; and he not only gave advice, but would sketch, wash in a sample sky, or do anything else necessary to help his young friend out of the strait.

MANOIR AT LE RUESNOY, NORMANDIE.

Often since has his generous gift of valuable information encouraged me toward similar generosity, when the natural impulse might have been "keep it for yourself."

I recall that he mentioned this matter of principality, but I was not in a condition to feel its need until a year or two later, when again it was brought to mind by reading Ruskin's "Elements of Drawing." By that time its value was appreciated, and though I used it badly and awkwardly for awhile, experiment and experience finally brought it into excellent service.

There is reason for hesitating to offer with much urgency anything like a rule in composition until such advice is really wanted, and it is best at first for the student not to be bothered with them. Nature first, by all means.

BARN AT CHATEAU EPREVILLE, NORMANDIE.

Beginners do well to be even skeptical of helps. Try them, if you will, when you feel the need, and when you have tried and proved them, they are your good servants, and will serve you well. At first a rule is too apt to be the master.

We do not have to go far to discover in the Creator's work use of this thought of principality and balancing repetition. Look at your hand. You may observe it in two ways; the palm or body of the hand is principal, the thumb is a large repetition, the fingers other smaller ones. Or consider the fingers themselves; the middle one principal, two fingers on one side, a finger and the thumb on the other side repeating. But these two groups are beautifully unlike, and altogether form a most interesting example of principality, variety in repetition, and perfect balance of parts.

There are instances in an artist's work where an unrestful impression is wanted, as perhaps in the representation of a battle scene, but generally, whether in a pictorial way or in design architectural or decorative, the effect desired is restfulness, repose, a quiet, simple result, grandly quiet if possible. To obtain this many things contribute, but the two items under our consideration are not of the least importance in the matter.

To clothe the thought in words, it may be put in this way: —

Any arrangement of form or values comprised in a picture or group should be so composed that the observer will easily look over the whole composition, but finally and always come back to some leading effect, stronger and more conspicuous than any other.

If the artist be wise, he will see to it that this principal interest is connected with some important part of the subject to be illustrated.

This principal effect may be a dark or a light, or be principal because of its superior size. There may be also in the same picture both dark and light as leading effects, for dark and light do not compete with one another.

There should be no competition for interest. If there are two or more strong points in any composition so equally attractive that the eye goes from one to the other and cannot rest on one of them finally as superior in interest, there is no repose. The intuitive artistic sense, or trained judgment, comes in right there to subdue this one, or pronounce that a little more, till one of the competing points takes proper precedence.

Good judgment will not overdo this by making the emphasis so loud that nothing else can be seen or heard but the principal effect. When best used it will not be very apparent, but, nevertheless, will exist visible to the eye of the observer who understands, and if the observer does not understand, he gets the impression which the artist intended to convey.

The very word "principal" suggests repetition. A large dark effect or principal form should have one or more smaller ones to repeat it to prevent a bold, staring rudeness in the principal one. These repetitions must not be forced or methodical. Neither principality nor repetition should give itself away.

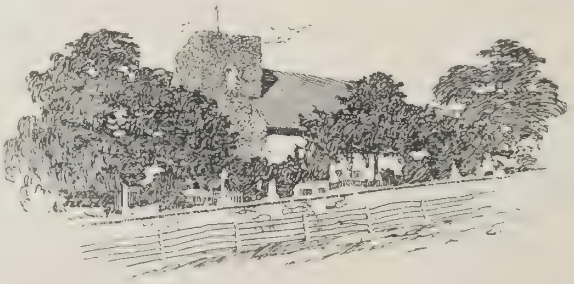
The drawing at the head of this article, *farmhouse near Château Chaumont*, illustrates our topic. The tree leads both in its conspicuous form and in its strength of black. The tower and its shadow are its principal repetition. The dormer and the foliage low down on the right are other repetitions.

Observe how easily your eye rests on this tree. But try the tower top, look at it steadily, and note how strongly you are drawn to the tree. You cannot rest your vision on the tower without a little effort. Yet the tree is not so strong but that one can look over the whole drawing, but — will finally return to the tree.

This drawing also illustrates in one portion of it the value of repetition in the way of balance. The tower stands between two chimneys. In the photograph from which this drawing was made, the chimney on the left did not exist. Cover up this chimney and see if your eye does not call for it as a repetition of the tower, also as a balance to the chimney on the right.

In this drawing, beside its principal dark, is its principal light between the tree and the tower. On the right of the tree is a repetition, and on the left of the tower, and smaller ones here and there.

The initial cut *Château de Blois* is an example of a rather bold leading dark and repetition. One feels the want of another on the left, — a balancing repetition.

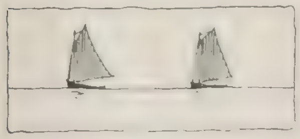


CHURCH OF ST. MARTIN, CANTERBURY, ENG.

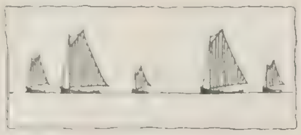
The two cuts following have, like the larger one, their principal dark and light.

The church of St. Martin differs somewhat from these in having no principal light. It can hardly be said to have a leading dark, as the whole drawing is one mass of values, and so as a whole it is one dark value. But in its forms the large foliage mass on the left takes precedence agreeably. Imagine the middle tree to be of the same size as the large one; there would then be competition and consequent lack of repose.

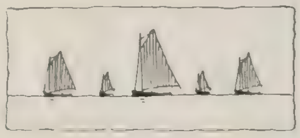
This simple marine diagram again illustrates the topic quite completely.



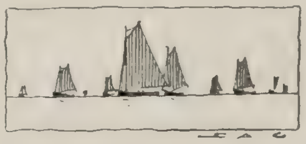
BAD COMPOSITION. COMPETITION, AND NO REPETITION.



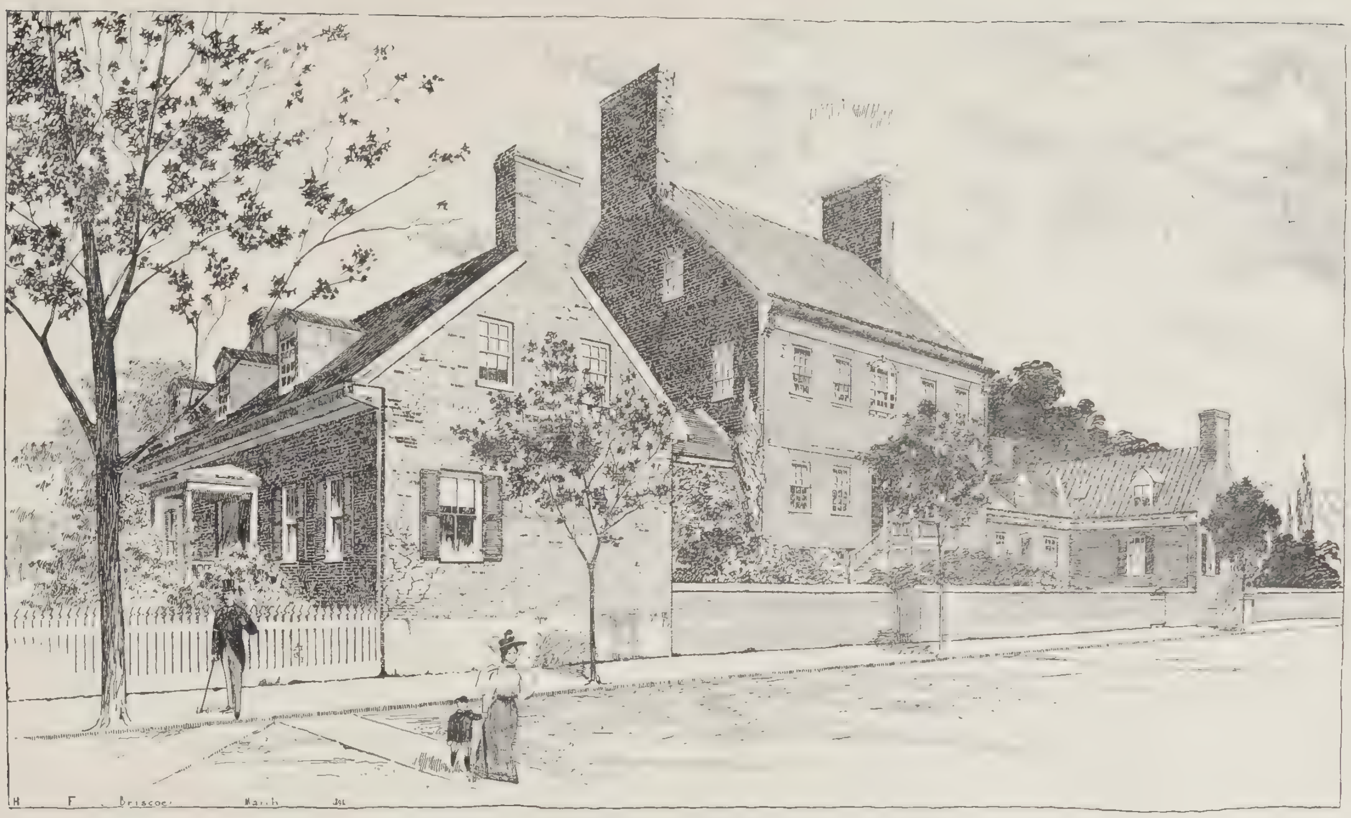
A LITTLE BETTER, BUT MONOTONOUS IN REPETITION.



STILL BETTER, BECAUSE OF A PRINCIPAL OBJECT.



GOOD COMPOSITION PRINCIPALITY, WITH VARIETY IN REPETITION.



· OLD · HOUSES · ANNAPOLIS · MD

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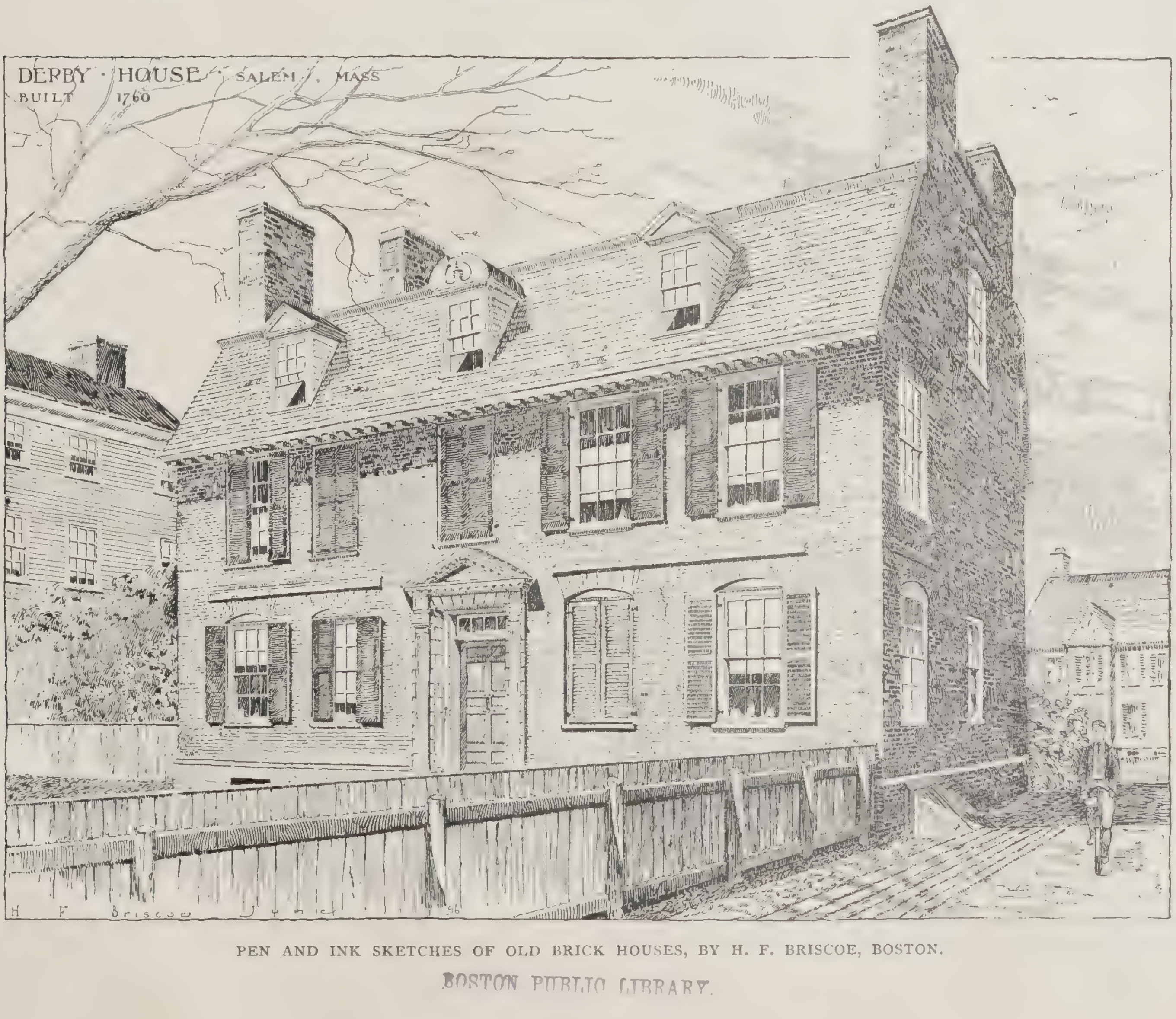

PEN AND INK SKETCHES OF OLD BRICK HOUSES, BY H. F. BRISCOE, BOSTON.

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Architects' Troubles with Brickwork: How They May Be Avoided. II.

BY F. E. KIDDER.

IN a previous article the writer mentioned the most common troubles that architects meet in their endeavor to obtain a good job of brickwork.

How to avoid the troubles cannot be so easily told, but the writer has found by much experience that many of them can be overcome, at least to a considerable extent, and for the benefit of the inexperienced architect he will endeavor to show as well as may be how to avoid them.

In general, it may be said that all the troubles mentioned can be best provided against by a thorough knowledge on the part of the architect of all the details that relate to the manufacture and quality of bricks, and the necessary conditions for obtaining good mortar, and also of the way in which brickwork should be laid. With this knowledge, the architect should draw up his specifications in such a way that the contractor will know just what quality of materials he must provide, and just how the work must be done. The writer believes that *indefinite specifications* are too often the greatest source of trouble to the superintendent who is anxious to secure a good piece of work, as it is very difficult to get most contractors to do a better piece of work, or to furnish better materials than the *letter* of the specifications requires, and if the latter contains any loopholes, the contractor is quite sure to avail himself of them.

Another way in which these troubles may often be avoided is by giving the work to a conscientious and reputable contractor; unfortunately, the architect is not always able to do this, but is required by the owner to accept the lowest bidder; but the architect should use his influence to secure a contractor having a reputation for doing good work, whenever he can do so.

The various sources of trouble mentioned in the preceding paper will be taken up consecutively, and the way in which they may be avoided or overcome discussed.

POOR BRICKS. The architect must, as a rule, adapt his brickwork to the material available in the vicinity of the building, and as the quality of bricks varies greatly in different portions of the country, the architect must have a practical knowledge of the quality of the bricks made in the locality where he is to build, and also of the different trade classifications of the bricks. It then only remains to specify exactly the class of brick he wishes used, and to firmly insist that no inferior brick shall be delivered at the building.

In most localities it is customary to specify for the common bricks, "good hard-burned common bricks," and generally this is sufficient; but in some localities, as in Colorado, there is quite a difference in the bricks that would come within that classification, and it is necessary to be more particular in the specification. For the best common bricks, it is customary to specify an end-cut stiff mud brick, and that no red or salmon brick shall be used. It is also customary to limit the choice to two or three brick-yards. For dwellings where no great strength is required, a "good red brick" may be specified. The writer has often found it necessary to specify, "Should any soft or salmon brick be delivered at the building, they are to be immediately hauled away, and the architect shall have authority to stop the progress of the work until the condemned material is removed." This is sometimes the only safeguard where there is no "clerk of the works," because, if the bricks are allowed to remain at the building, they are quite sure to be worked in.

The young architect will find that the best way to get along with contractors who are inclined to use poor materials is to be very firm at the start, and to promptly condemn and demand the immediate removal of any material that does not come up to the requirements of the specifications.

With pressed brick there is not apt to be much trouble, as the particular make and grade of brick is generally specified, and these run much more uniform than common bricks. If a poor make or grade of pressed brick is specified, however, they will have to be accepted, as the architect cannot compel the contractor to get another grade or make.

The importance of wetting the bricks, and especially the common bricks, before laying, was emphasized in the previous paper, and the architect should be sure to specify that "all common bricks shall be well wet in the pile, except in freezing weather, just before being laid," and he must see that this requirement is complied with if he wishes to get a strong wall. If he is confronted with the statement that wetting the bricks is unnecessary, he can quickly disprove it by lifting a few bricks that have been laid dry, and showing that the mortar does not adhere to them. It is very seldom that the mortar will be found adhering to the bottom of a dry brick, but unless the mortar is very poor, it is sure to adhere to a wet brick.

LACK OF SUFFICIENT MORTAR. This is a trouble that is often hard to overcome unless there is constant superintendence. The specifications should require that "all common bricks are to be laid with a shove joint in a full bed of mortar, all interstices being thoroughly filled, and where the brick comes in connection with anchors, each one shall be brought home to do all the work possible." If, on the first visits to the work, it is found that this requirement is not being carried out, the architect should have a portion of the wall taken down; and if the joints are found only partially filled, he should condemn such portions of the work as he has reason to believe is in a similar condition, and give the contractor to understand that a similar course will be pursued as long as there is any indication that the work is not being properly done. A bold step should be taken in this direction at the very first, if there is any indication of the work being slighted. It is also a good plan to visit the work at different hours, so that the men may not know when to expect the architect. There are some contractors with whom these precautions are unnecessary, and there are a great many, the writer is sorry to say, whose work must be very closely watched, and the only way to deal with them is to let them see at the start that it will not be profitable for them to undertake to use poor materials or to slight the work. In the case of piers, or portions of the walls that have to sustain considerable weight, it is the writer's custom to require that the work shall be *grouted*, either in every course or every third course, according to the importance of the work. The advantage of this is, that while a grouted wall may not be stronger than one laid with wet bricks and a full shove joint, grouting is less likely to be poorly done, and it always shows on the surface of the wall, so that it is impossible to omit it without the omission being readily discovered. Again, the water used in grouting penetrates the bricks more or less, and causes greater adhesion with the mortar.

TO AVOID TROUBLE WITH THE MORTAR, a good quality of lime must be specified, and where lime is obtained from several sources, it is well to specify the particular source from which the lime is to be obtained. The sand should be sharp, free from loam, and not too fine or too coarse. It is a good plan to specify that "the mortar must be mixed to the satisfaction of the architect," and on the first visit an inspection of the materials and the mortar should be made, and it will be well to have a small batch of mortar mixed in the proportion of about one bucket of lime part to two of sand to serve as a standard. By making himself familiar with the appearance of this standard mortar, the architect will soon be able to tell at a glance, or with a trowel, whether or not too much sand has been used. There will be little danger of too little sand being used.

TO AVOID THE FADING OF COLORED MORTAR, one of the well-known high-grade brands of mortar color should be specified, and the superintendent must see that it is not mixed with freshly slaked lime, and that it is used in proper quantity. It is a good plan to have a little colored mortar mixed a few days before it will be needed, and to have a few bricks laid with it, so that the final shade of the mortar may be determined, as the mortar is usually of a much darker shade when wet than when dry.

To avoid crooked walls, the architect or superintendent should frequently sight along the front of the walls and try the corners and jambs of openings with a plumb rule. A little trouble in this way will often prevent much vexation when the building is being finished. Where brick walls are built below grade, the architect should caution the contractor against filling against them until the floor joist above are in place, and the wall carried some two feet or more above them. A "green" brick wall will withstand very little side pressure, and the writer has known of serious trouble resulting from not observing the above precaution.

EFFLORESCENCE ON BRICKWORK. The appearance of a white efflorescence on the outside walls of brick buildings often causes vexation both to the architect and to the owner. The writer does not know of any practical way in which this can be absolutely avoided, as even where precisely the same materials are used, it may appear on one building and not on the others. About the only precautions that can be taken to prevent the appearance of the efflorescence before the building is finished is to select such bricks as have not generally shown a tendency to efflorescence and to use a lime that is free from magnesia. Too much wetting of the pressed bricks, the writer has observed, sometimes brings on the efflorescence, and it is therefore best to dip each pressed brick, for an instant only, in a bucket of clean water just before laying. After a building is completed, the efflorescence may appear and it may not. If it does appear, it can be washed off with clean water and a scrubbing brush. If it continues to reappear, the wall should be treated with oil, or some preparation, such as Cabot's Brick Preservative, that will render the bricks impervious to moisture.

CRACKS IN BRICK WALLS. The presence of cracks in brick walls is usually more the fault of the architect than the builder, as they are generally the result of an improper arrangement of the constructive features.

The various causes of cracks in brick walls and piers are: —

1. Insufficient or badly proportioned footings.
2. Shrinkage of timber built in the brickwork.
3. Unequal settlement due to compression in the mortar joints.
4. Overloading of the brickwork, and insufficient bearing plates.
5. Thrust of arches.
6. Poor material and workmanship, and insufficient bond.

Cracks are less liable to appear in a plain dead wall than in one pierced by many openings, and are also less frequent in brickwork that is laid in cement mortar.

Probably 50 per cent. of the cracks which are so often seen in brick buildings of only two or three stories are due to the first of the above causes. In large and important buildings the foundations are apt to be more carefully proportioned, and a better quality of material used, so that cracks are less frequent in such buildings.

For the ordinary brick building it is customary to continue the footings of the same width all around the building, regardless of openings in the wall, and wherever wide openings occur there is quite sure to be a crack in the wall below. Another common fault is that the foundations are not carried to a sufficient depth below the grade line. The manner in which cracks are produced by an improper arrangement of the footings has been so fully shown by Mr. A. H. Dyer, in the September to December, 1895, numbers of THE BRICKBUILDER, that the writer will merely refer the reader to those articles and recommend that they be carefully studied by the young architect.

There are still, however, a great many cracks that are not caused by settlement in the foundations, and most of these can be easily avoided by a little care and foresight in making the plans. In the portions of the country where isolated brick dwellings are most frequent, it is quite common to support parts of the brickwork by wooden timbers used as lintels, or girders. As it is practically impossible to secure thoroughly seasoned timber for such purposes, the girder or lintel is quite sure to shrink in the course of time, and a crack in the wall above, starting from the end of the wooden beam, is the inevitable result. If the architect, therefore, does not want cracks in his walls, he should never use wood for their support, and it is a good rule to place no wood at all in a brick wall, except as centers for relieving arches, and the ends of joists and girders. Even bond timbers and wooden bricks should be avoided.

Wherever a wall is considerably broken and rises to different heights, the effect of the compression of the mortar joints should be carefully considered. The shrinkage or settlement of lime mortar, although not very great, is still sufficient in a height of thirty feet to produce a crack, where the settlement is not uniform. When three or more windows are placed in a wall, directly above each other, it is quite common to see a crack in the stone sill of the lower window, if the sill has a lug, and very often a small crack in the brickwork above the lug. This crack is caused by the settlement of the brickwork at the side of the window. In such cases, it is a safe precaution to use slip sills in the lower openings. Brickwork laid in cement mortar settles very little, if any, and hence when cement is used, cracks produced by this cause are seldom seen.

First-class workmanship and materials and thorough bonding are also a safeguard against cracks, although they cannot be counted upon to offset bad designing.

Cracks due to overloading are less excusable than any others, as they can be avoided with certainty by properly proportioning the area of the wall or pier to the load, and by the use of bearing plates of proper size.

In conclusion, it may be said that to obtain a well-built brick building that will stand without cracking requires much more care and intelligence in laying out the structural features than is usually bestowed upon wooden buildings, and generally more thorough and competent supervision. While it is, perhaps, impossible to prevent an occasional small crack or some minor defect in the work, still, by carefully looking for the cause of such cracks as may occur, and by conscientiously following the suggestions that have been offered, the architect should be able to obtain for his client a very satisfactory and creditable building. A brick building, when well designed and built, is probably the most durable and satisfactory of all buildings.

BRICK FOR FOUNDATIONS.

IT is very commonly assumed that the only proper material for the foundations of a country house is stone in some form. Any one who has given the matter any thought, however, cannot but feel that stone in the rubble form, which is usually employed for house foundations, is anything but satisfactory. If the masons would carefully fill all the joints and thoroughly bond all the courses, and would lay up a wall with two faces so it would not catch surface water on external horizontal projections, there would be more in favor of a rubble wall; but as a matter of fact, the average house cellar wall is laid up partially dry with little dabs of mortar at intervals through the wall, and is then pointed after a fashion from within, and the exterior of the wall is left in a crude, unpointed state, while the bonding is so inefficient that very often the only thing that keeps the wall from falling out is the resistance of the external earth. From nearly every point of view brick would be far preferable for foundation work, provided a proper quality of brick were used. Nothing but the very firmest hard brick, and preferably one which was burned to vitrification, should be used for cellar work. A brick wall can usually be laid up more quickly than stone; it requires less labor on the part of the men to handle the material, and in case of wet or freezing weather the wall is less apt to be damaged. A 12 in., or, at most, a 16 in. wall of brick laid up with mortar, half lime and half cement, with the joints thoroughly flushed and the work bonded every five courses, would answer for foundation work a great deal better than even the best of rubble stonework. The price for thoroughly first-class rubble stonework in the vicinity of Boston is $4 per perch. A 12 in. brick wall would be equivalent in strength to the ordinary 20 in. rubble wall, and, consequently, a perch of stone would be the equivalent of 350 bricks, which, at say $17 per 1,000, laid, is nearly $6. In other words, the bricks would cost about 50 per cent. more than stone. The result, however, would be a far better and more satisfactory wall, and one which we are inclined to believe would be much more proof against dampness from the outside.

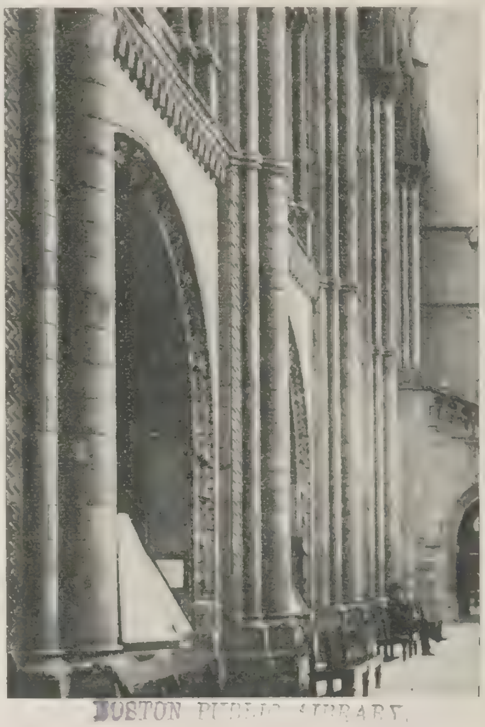
Architectural Terra-Cotta.

BY THOMAS CUSACK.

(Continued.)

IN the course of business correspondence with an architect some weeks ago, on the visibility or otherwise of mortar joints, and in relation to certain work then in course of execution, we took occasion to cite this building as a precedent, sending him a copy of one of these photographs in support of a similar contention. Said architect is known to us only through his drawings and very pointed written directions, from which we conclude that he is a man of taste and discernment, whose aim is to merit a high rank in his profession. The style of his work was a free rendering of French Renaissance, not without points of originality, and full of delicate ornament. This demanded close and neatly made joints, arranged in unobtrusive places, and, as he himself pointed out, had to be looked at from a somewhat different standpoint to that which would be applicable in work of a vigorous Norman or Romanesque character. In this view he was certainly correct, but, after all, joints are inseparable from construction, the one being a necessary corollary of the other. We have seen many attempts made to conceal them, but like similar subterfuges resorted to with the object of concealing the truth itself, they invariably resulted in failure, finally becoming known among workmen as "sham joints." We repeat that there can be nothing objectionable in a properly placed and skillfully made joint of, say, three sixteenths of an inch. It is only when ornament has been mutilated, and the edges of the blocks smeared with mortar by a slovenly workman, that the *alleged* joints become an eyesore sufficient to mar an otherwise excellent piece of work, on which care and skill had previously been expended.

Innumerable instances of joints as thick as the bricks themselves may, of course, be cited from well-known relics of Roman and medieval builders, but these are hardly applicable in the case of modern brickwork; unless, indeed, we accept their methods of construction, and build the whole of the wall as they would have done. With them, the greater portion of the wall was of concrete, forming a matrix into which the brick or tile was embedded. Each alternating course acted as a casing, and held the semi-liquid mass in position until it had set, when it became a veritable monolith. Not only were the walls of the Pantheon built in this way, but the dome itself, being so constructed, is without lateral thrust on its abutments; and now, after a test of two thousand years, there are no signs of spreading or of failure in the constructive features of this ancient but most enduring of architectural landmarks. The thick mortar joints were accepted as a concomitant of prevailing methods of building, but were not sought after, as in some quarters they appear to be with us, merely with the view to a supposedly picturesque effect. How people will follow the shadow, and forget all about the substance! Some architects are prone to the same kind of mistakes as physicians have been known to make, in treating the symptoms instead of seeking for the cause that produced them. They have not, as yet, so far as we are aware, got the length of deliberately leaving out a brick or two at regular intervals, in imitation of the putlog holes seen in the medieval brickwork of Italy and elsewhere. But the faddists among them appear to be retrograding rapidly in that direction. It is well to remember that "too far east is west."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EXAMPLE OF JOINTING, NATURAL HISTORY MUSEUM, LONDON.

Among the later instances of really good terra-cotta architecture in England may be mentioned the City Bank, Ludgate Hill, and the Royal English Opera House, Cambridge Circus, London, both of them by Mr. T. E. Colcutt. The color in each case is a tawny buff, with bricks of a darker shade. Architecturally the effect is at once appropriate and prepossessing, but on closer observation it will be seen that every detail has been worked out with scrupulous exactness. The setting of the work bears the indubitable evidences of care and deliberation, and the result is as nearly perfect as could reasonably be expected. On the subject of setting we shall have occasion to speak at some length in a subsequent chapter, but in passing, we are obliged to remark that in this important branch of the work, and in it alone, the English terra-cotta makers have a distinct advantage over anything to which we are accustomed in this country. The difference consists chiefly in the simple but fundamental fact that the British manufacturer sets his own work, and either employs directly a trained staff of skilled workmen, or sublets the setting to an experienced, responsible contractor, who in turn makes the business a specialty. Such a man has, by superior intelligence and industry, graduated from the ranks of workmen such as he employs. They are not, strictly speaking, stonemasons, nor yet bricklayers, but they have learned

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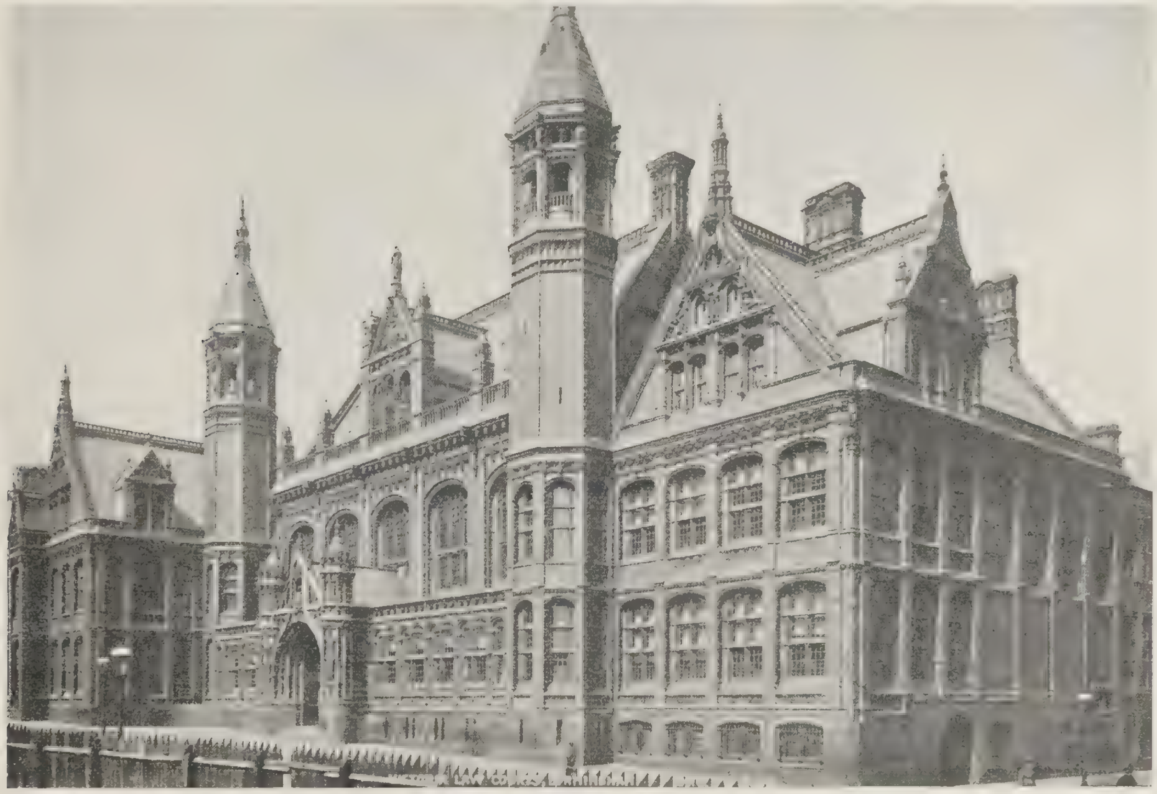
THE ROYAL ENGLISH OPERA HOUSE, LONDON.

the art of setting terra-cotta "in a skillful and workmanlike manner," — words that are written or implied in every one of our specifications, — but how often are they enforced in every-day practise? Work that has been properly set redounds to the credit of the architect, gives satisfaction to the owner, and does simple justice to the material.

Work that has *not* been properly set — and of it we have a plenty — does the reverse of all this. The time must, and we believe it will come, when the terra-cotta manufacturers will no more think of allowing their work to be hashed by inexperienced and irresponsible setters than would the stone or marble masons. When that time comes we will be able to afford terra-cotta doorways, vestibules, and interiors, and we will then start on the first, instead of, as now, on the fourth story, as though our work had to be held a sufficient distance from the eye, merely to "lend enchantment to the view." Until then, terra-cotta will have to struggle onward and upward in the face of a few remaining obstacles to its complete success, and of which this one is now the most formidable. Formidable it undoubtedly is, but who will say that it is insuperable?



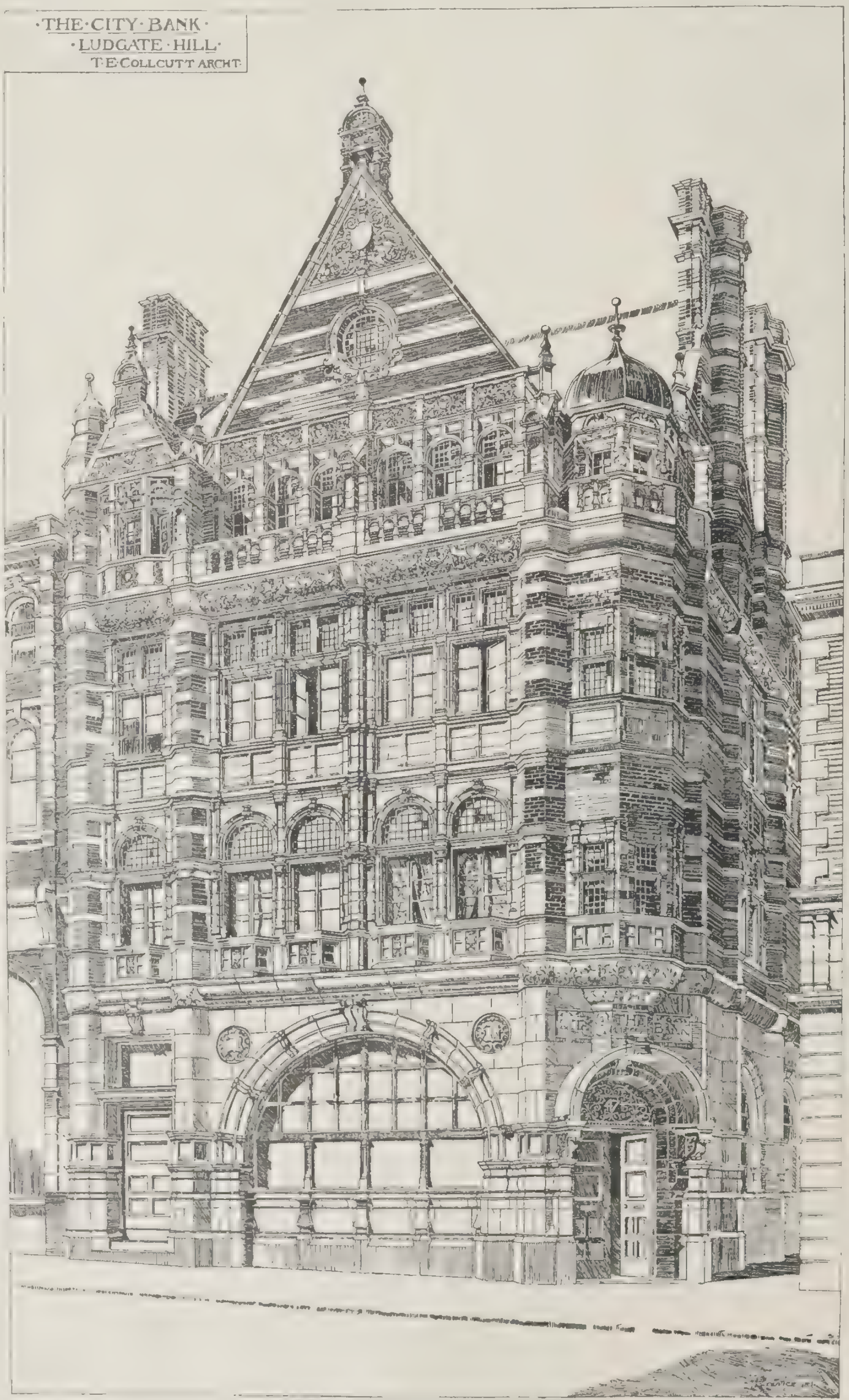
BOSTON P

VICTORIA LAW COURTS, LONDON.

With the continued improvement of the manufactured article, and this obstacle removed, we, too, will gradually climb down to the street level, as they have done in England. We know of several instances where the experiment has been tried without experiencing any reason for regret. The very best one with which we are acquainted is on the Harrison Building in Philadelphia, where Messrs. Cope and Stewardson had the courage to submit the terra-cotta to this most crucial test. And taken as a whole, we have seen few better things on either side of the Atlantic. Mr. Sperry, of Baltimore, has done the same thing on the Brewers' Exchange now under way in that city. Mr. Charles Edwards has likewise followed their example in the Hamilton Club Building in course of erection in Paterson, N. J., and there are doubtless many more to follow. It but remains for the terra-cotta makers to show by the quality and finish of their work that they are equal to their opportunities, and these exceptional instances will become the precursors of a new movement.

The Victoria Law Courts, Birmingham, by Aston, Webb, and Ingress Bell, takes a front rank among the most successful and reassuring efforts yet made in burned clay. The color chosen for the exterior is a bright cherry red, and for the interior a yellowish buff; the former, we believe, from the works of Mr. J. C. Edwards, Ruabon, North Wales, where there are inexhaustible beds of a red-burning clay, unequaled, perhaps, for purity and uniformity. The extreme hardness and density of the blocks when burned have become a byword among terra-cotta makers. All attempts made to chisel the joints with the finest-tempered tools have been found impracticable. Hence the "fitting department," though universal with us, is unknown at Ruabon. It will be seen from this how necessary it is that every block should be geometrically and mechanically accurate in size and shape as it comes from the mold. Once burned, its destiny is sealed. If alterable at all, it is so to a very limited extent, and the best remedy is usually a remake, provided there be a sufficient margin of time before the work is wanted at the building. If not, the architect and builder will find themselves between the horns of a most exasperating dilemma. They will have to choose between a misfit or a month's delay, neither of which is likely to create a favorable impression of the material, or of the men responsible for the making and prompt delivery of it. There was a time, and of it we have a very lively recollection, when the most ludicrous blunders were of daily occurrence in the neighborhood referred to, and that, too, in the execution of work which would now be considered simple, if not elementary, and within the capacity of the veriest tyro. This state of things, we are glad to believe, is largely reminiscent. With new men have come new and improved methods, and the ability to handle more abstruse problems in draughtsmanship and construction, with a fair degree of success. Taking to themselves Hamlet's advice to the players, they have not only reformed it indifferently well, but have sought to "reform it altogether." Judged by the Birmingham Law Courts, we think that the manipulation of terra-cotta has reached a higher plane of intelligence at Ruabon during the past ten years than existed there previously. This must be gratifying to architects and others who believe in the future of a product that has hardly an equal in point of density and brilliancy of color. Nature has certainly done her share in the extent and quality of the raw material.

The planning of this building was of course governed by the complex nature, as well as by the amount of accommodation which had to be provided in a center of legal and business activity second only to that of the metropolis. The grouping conforms closely in its main features to that of the strictly utilitarian plan; but in matters of detail, the architects being free and untrammeled, have made the most of their opportunities. The style approximates more closely to a phase of early French Renaissance than anything else we can think of, with the Gothic feeling somewhat accentuated. Yet the blending of the two distinct characteristics is so skillfully managed that one loses sight of the transition in the presence of a really pleasing, if not original, transposition. The air of unity and consistency that pervades the whole composition gives it a character of its own, with hardly a discordant note.



The three buildings that have been mentioned are, and no doubt will continue to be, the forerunners of others similar in style, and built of the same excellent material. They cannot fail to influence the architecture of the future, and will certainly stand as types of work of a purely native growth prevailing in the last quarter of the nineteenth century.

An extensive group of recent terra-cotta work may be seen within a short distance of Temple Bar. It extends throughout a number of streets from Essex Street westward to King's College, and from the Strand to the Victoria Embankment. In it we find offices, residences, hotels, and sundry business premises, including the famous book-selling establishment of the Right Hon. W. H. Smith, once First Lord of the Admiralty, and Conservative Leader of the Commons. The rebuilding of this colony, in which terra-cotta figures so prominently, has been carried out during the past few years. It is now a highly picturesque neighborhood, containing much that is of interest, but we think the desire to be ornate has been allowed too much license. The profusion of ornament is, if anything, overdone, and unnecessarily small members are introduced far too frequently. They serve no useful purpose, and but suggest the miniature proportions befitting a doll's house, rather than the homes of stern business realities.

A pleasant walk along the gardens of the embankment brings us to the National Liberal Club, which is stone, but Mr. Waterhouse has employed color faience and tile decoration in the dining and smoking rooms on an extensive scale, and in a way that is worth seeing. Turning into Whitehall, just opposite the Home and Foreign Offices, may be seen a specimen of refined terra-cotta that is probably unique in its texture and workmanship. The elaborate entrance, and indeed all the work on the first story, is so perfect in every detail that it took us some time to determine whether it was terra-cotta or Portland stone, to which some master-mason had given the finishing touches. The Constitutional Club, on Northumberland Avenue, for which R. W. Edis is responsible, we cannot help regarding as a wasted opportunity, both in design and execution, and one that it would be hopeless to palliate or deny. It is heavy, stupid, uninteresting, and encumbers one of the most desirable sites in London, within view of what has been described as "the finest site in Europe." Its presence, so near Trafalgar Square, is enough to make Landseer's lions unite in brazen protest. We were instinctively reminded of General Sheridan's laconic but significant rejoinder when asked his opinion of the Pension Office — "They tell me that the darned thing won't burn."

(*To be continued.*)

No one can deny that the study of Italian brickwork must be useful to those who are compelled, as we so often are, to use the same material in buildings for whose good architectural effect and character we are anxious. . . . We need not, in attempting to rival its beauties, confound them with faults which were essentially those of the whole Italian style. We may with the greatest advantage emulate the Italian system of brick window tracery, whilst we take care never to imitate the equally common custom in Italy of erecting sham fronts in order to display our traceries. Again, though they never used any but red bricks, there is no reason why we should not enliven our work with the contrast of other colors. — *Street.*

Fire-proofing Department.

TESTS OF FIRE-PROOF FLOORS.

THE third test of the series being made by the Department of Buildings of the city of New York to determine the resistance of fire and water of various systems of fire-proof floors was made on September 29 at the testing ground at 68th Street and Avenue A.

We give below the results of this test as furnished us by Mr. Howard Constable, under whose immediate supervision the test was made.

MR. CONSTABLE'S REPORT.

The floor tested covered a room 11 ft. by 14 ft. in the clear by 1 ft. high, with walls 12 ins. thick, of common brick set in machine-made mortar, and below the bottom of the room was constructed double grates so as to secure an intense fire.

The floor itself was made of 10 in. beams, 25 lbs. per foot, set 4 ft. apart. The filling between the beams was 10 in. flat arch blocks of porous terra-cotta, end construction, with soffit tile to protect the lower flanges of the beams, and all set in Portland cement. The ceiling was finished as usual with machine-mixed mortar and white coat ¾ in. in all, excepting that one third of the whole ceiling which was left unplastered so as to test the blocks of terra-cotta unprotected by the plastering. The top of the terra-cotta blocks was covered with a concrete of cinder and cement to the height of 1 in. above the beams, and in which were imbedded the usual 2 by 4 sleepers 18 ins. on centers ready for the wooden floor. This floor was then weighted down the middle section 4 ft. by 14 ft. with a load equal to 150 lbs. per square foot of this section, and so loaded that the weight was all on the filling and not on top of the beams. Small spaces were left under and through this load so that fires could be built on top of this floor, besides the fire applied in the room below. The fire in the room below was started at 9 A. M., and consisted of oak and hickory cord wood and ignited with a little crude oil.

9.05. White plaster commenced to peel.
9.15. Flames issuing from chimneys.
9 47. Top of floor warming up.
10.00 Wire glass in peep-hole melted.
10.25. Refiring.
11.30. 2,000 degs.
12.00. „ „
12.25. „ „
12.25. Refiring.
12.25. Brick on window jambs vitrifying.
1.18. Refiring.
2.00. 2,200 degs.
2.00. Fires on top of floor lighted.
2.25. 2,200 degs.
2.26. Re-firing.
2.50. 2,000 degs.
3.00. Water from fire engine at 60 lbs. pressure through 1⅜ in. nozzle to put on ceiling for 11½ minutes.
3.19. Top of floor flooded with water.

Measurements showed that the centers of the floor deflected with
150 lbs. per square foot before the fire —— ins.
150 „ „ „ „ during the fire 2.14 „
150 „ „ „ „ after water applied 46 ins.

Inspection after the fire showed that a number of the soffit tile and arch blocks were cracked and broken off by the intense action of the water, but that no opening had been made through the floor by the fire, or afterward by the stream of water, and that there remained great strength to the floor, as on the following day the loading was increased to 600 lbs. per square foot without breaking through, thus showing a factor of safety of over four. The work is now being done of trying if 1,200 to 1,500 lbs. per square foot will break the floor through. Inspection after the fire also showed that some of the heavy cast-iron grate bars had melted.

As the previous test to this one registered 2,250 degs., and as this furnace was slightly better built for firing, and as the same kind and proportionate amount of wood was consumed and the firing attended to by an expert from one of the greatest boiler manufacturers, and as the wire glass melted about the same time, and I had tested the metal pyrometer used, and as the bricks of the window and in peep-holes vitrified and the grate bars melted, there can be no honest doubt but that this was one of the most severe tests ever made.

I also am free to state that the floor, while a good one, was not a phenomenal one, first, because one of the best-known terra-cotta manufacturers claimed while the floor was being laid that he did not want his name connected with it, as he could furnish better material and workmanship; and second, because there have been many floors put in of the same spacing of beams and thickness of arch blocks, a partial list of which is as follows: —

TEN-INCH FLAT ARCHES USED.

115 Chambers Street, 3 ft. 5 ins., 3 ft. 10 ins. to 4 ft.

Broadway and Howard Street, average span about 4 ft. 8 ins.

Five Points Mission House, average span 4 ft. 10 ins. to 5 ft.

Johnson Building, Broad Street and Exchange Place, 4 ft. to 5 ft.

Manhattan Bank Building, 40–42 Wall Street, 3 ft. 9 ins., 4 ft. 2 ins., 4 ft. 6 ins., 4 ft. 9 ins.

Broadway and 25th Street, 3 ft. 9¾ ins., 3 ft. 11½ ins. 4 ft. 2 ins., 4 ft. 4½ ins., 4 ft. 5 ins. to 5 ft.

Fourth Avenue and 19th St., 3 ft., 3 ft. 7½ ins., 3 ft. 4½ ins., 4 ft. 6 ins. to 5 ft. 9 ins.

New York Life Building, Broadway and Leonard St., average span 4 ft.

St. Paul Building, Broadway and Ann St., 3 ft. 6 ins., 3 ft. 10 ins., 3 ft. 11 ins., 4 ft. 2 ins., 4 ft. 3 ins., 4 ft. 5 ins.

State Capitol, 3 ft. 7 ins., 4 ft.

TWELVE-INCH FLAT ARCHES USED.

Liberty Building, Liberty and West Streets, 4 ft. spans throughout.

Metropolitan Building, Broadway and Prince Street, 3 ft., 3 ft. 4 ins., 3 ft. 6 ins., 3 ft. 10 ins. to 4 ft. 10 ins.

Broadway and 12th Street, 3 ft. 3 ins., 4 ft., 4 ft. 2 ins., 4 ft. 6 ins., 4 ft. 4 ins., 4 ft. 7 ins., 4 ft. 11 ins.

37–41 East 18th Street, 3 ft. 10 ins. to 5 ft. 3 ins.

Kilpatrick Building, 67th Street, between Eighth and Ninth Avenues, 4 ft. 2½ ins., 4 ft. 4 ins., 4 ft. 4 ins.

Respectfully submitted,
HOWARD CONSTABLE.

TEST OF THE FAWCETT SYSTEM.

A similar test was made, on September 10, of the system of floor construction manufactured by the Fawcett Ventilated Fire-proof Building Company, Limited.

In this system steel beams are used a uniform distance of 2 ft. apart. Terra-cotta lintels of a hollow cross-section are supported on the lower flanges of the beams in such manner that the under side of the lintel is about 2 ins. below the beam. An air space is thereby formed between the lower flange of the beam and the base of the lintel. Above the lintel the space is filled in with concrete.

The test was made in a brick building erected for the purpose, on a lot at the corner of 68th Street and Avenue A. The building was 14 ft. by 11 ft. inside, by 10 ft. high. The roof was formed of the Fawcett floor, 6 in. beams being used, running lengthwise of the building, and the floor being designed to carry safely 150 lbs. per square foot. A small chimney was placed at each of the four corners of the roof and a grating was fixed near the bottom, covering the whole inner area. The ceiling was made of common plaster laid directly on the bottom of the lintels, which were grooved with dovetails so as to retain it. Several cords of wood were placed on the grates, some kerosene was sprinkled on it, and the fire was lighted at 9.33 A. M. By 10.30 the pyrometer had reached 1,850 degs. Fahr., and the maximum temperature of 2,200 degs. was recorded at 10.50 A. M. At 11.10 A. M., the wood having partly burned out, the temperature had gone down to 2,000 degs. The walls of the building had by this time cracked badly from expansion of the brick on the inside. More wood was put in between 11.20 and noon, but the temperature could not be brought higher than 1,850 degs. When the maximum temperature of 2,200 degs. was reached, the roof, which had been loaded with brick on the two central panels to 150 lbs. per square foot, had sagged down about 4 ins., due apparently to expansion of the lower flange of the beams by the great heat. At 12.20 P. M. water was thrown into the building by the fire department, the stream of 60 lbs. pressure being directed against the ceiling. When the building had been cooled sufficiently to allow persons to enter it was found that the only damage done was the sagging of the beams, the removal of most of the plaster, and the breakage of the base of several of the lintels. The concrete above the lintels remained in place. On September 11 the test was continued without fire, by adding to the load on the two central panels of the roof up to 600 lbs. per square foot without any further damage being visible. During the fire test the fire did not break through the roof at any point, and the upper surface remained so cool that the hand might be placed upon it.

AN extraordinary sort of fire-proof lathing has been introduced into Germany, consisting, essentially, of little cross-shaped bits of terra-cotta strung on wires, which pass through them in two directions, at right angles with each other. One would think that such a combination would be expensive, but it is claimed to be cheaper in use than ordinary wire lathing, inasmuch as the terra-cotta crosses take the place of a large part of the plastering mortar. The mortar is said to adhere very strongly to the terra-cotta, in addition to the excellent clinch afforded by the network, and, of course, the fire-proof qualities of the material are nearly perfect. The crosses are stamped out of clay, and are, presumably, strung on the wires by machinery. It is sold in rolls one meter wide and five meters long, containing thus nearly six square yards, at three marks and a half, or eighty-four cents. This is quite as cheap as plain wire lathing, to say nothing of the saving of mortar by its use, and the application of the new lathing seems to be even easier than that of ordinary wire lathing, as it gives a good clinch when nailed directly to boarding or timbers, without furring. The German manufacturers are Herren P. Stauss & H. Ruff, Cottbus, Germany. They advertise that their foreign patents are for sale, and it would certainly be desirable to have so promising a material put into the hands of a public so much interested in fire-proof construction as that of the United States.— *American Architect.*

THE new fire-proof mercantile building for the Wyman-Partridge Company, at Minneapolis, Minn., is to be floored with brick arches instead of hollow terra-cotta, as was at first intended. The change was made to brick in order to save expense. This is the first time that this idea has been adopted in the Northwest. The brick is cemented together between I beams in arches 16 ins. high and about 10 ft. span. The beam is being secured at extremities of concave side of arch by iron stringers to prevent spreading. A section of the main floor has been subjected to a load of 650 lbs. per square foot under which there was a deflection of 1 in. only. A further test was made by dropping an 800 lb. piece of granite from a height of from 6 to 8 ft. On second drop, a few bricks at the center of arch were effected, but nothing further. This test was considered satisfactory by the architects.

Mortar and Concrete

A DEPARTMENT DEVOTED TO ADVANCED METHODS OF USING CEMENTS AND LIMES IN BUILDING CONSTRUCTION.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING. (*Continued.*)

IN February, 1895, Cecil B. Smith, Ma. E., A.M., Can. Soc. C. E., Professor of Civil Engineering, McGill University, Montreal, delivered before the Canadian Society of Civil Engineers the following exhaustive dissertation on the TESTING OF CEMENTS, which, through his courtesy and the courtesy of the society named, we are permitted to publish in full: —

CEMENT TESTING.

This subject has so often been written on, and is being so continually and persistently investigated, that it forms, as it were, an inexhaustible mine.

But this very feature shows how very important and yet how little understood it is, for when investigators continue to disagree, the presumption is that there is either a lack of agreement as to the basis on which the investigations are made, or else a failure, up to

TABLE I. STANDARD CEMENT TESTS.

Nationality.	Date of Standard.	Authority of Standard.	Weight per Bushel or C. F.	Specific Gravity.	Chemical Analysis.	Residues or Fineness.	P. c. of Water in Mixing.	Constancy of Vol. or Blowing Test.
Canadian.	1894	Recommended by Committee of C.S.C.E.	Considered to be indefinite and of little value.	3.12 to 3.25 for Portland.	Not more than 2% Sul. Acid. Not more than 5% Magnesia. Portland. Lime 0.05, Silica 24.31, Al & FeO_2 10.84, Mag. 3.00, Alkalies 1.60 Natural. Lime 37.18, Silica 28.11, Al. 27.62, Mag. 7.09	Less than 5% on 50 sieve No. 35 Stubbs gauge.	Standard consistency, rod .4" diar., 66 lbs. to nearly penetrate mortar in a box 3" diar. 1½" high.	24 hours in water at 120° F. and 27 days in ordinary water or Final test, 24 hours after setting in boiling water.
English.	1893	Standard Practise no Regulations.	About 112 lbs. per bushel for Portland.	Not less than 3.10 for fresh or 3.07 for 3 months old (dried 15 minutes).	Recommended to be made.	5% on 80 sieve 12% on 100 ,, 25% on 150 ,, 30% on 180 ,, wire mesh.	Approximately 25% Neat 12% 3 to 1, Faija mixer.	Same as above, of which this is the original.
United States.	1885	Recommended by A. S. C. E. generally used and adopted.	(Authority of Clark.) French Port 69 per CF, English Port 78 to 87 per CF, American Port 95 per CF.	Not specified.	ditto	5 to 10% on 50 sieve down to 3 to 10% on 176 sieve.	Approximately 25% Neat Port., 30%, Neat Natural, 15% 1 to 1, 12% 3 to 1 stiff mortar.	1 pat in air 1 month for signs of discoloring, 1 pat in air till set, then 1 month in water for checking.
German.	1893	Government Regulations.	370 lbs. per barrel net.	3.12 to 3.25 for Portlands, increase with age.	ditto	10% on 76 sieve wire ½ of mesh.	Same as the Canadian, which is a copy of this one.	23 hours in air, 1 hour boiling, or submerged 28 days, no checking in either test.
French.	1884 or later.	Government Regulations.	1 litre to weigh within 3½ ozs. of heaviest cement from same factory, all sifted through No. 100 sieve.		Not more than 1% Sul. Acid Not more than 4% Fe O_2. When Si. and Al. are less than 44% of lime.	None specified, argued that fine grinding gives high strength in periods of tests chiefly, which disappeared later on.	Sea water, standard consistency round ball dropped 20" on slab to retain its general form without cracks.	Pat in sea water ($\frac{2}{1}$) days, no cracking or bulging.
Austrian.								

the present, to solve all the intricate mazes of the problem, or indeed a combination of the two.

To illustrate the first point, a tabular synopsis (Table I.) is presented, giving the present standard tests in use, in various countries, according to the latest obtainable information. The variations, in many cases, are too great to be reconciled, in others trifling; but it is evidently difficult to compare results obtained in different countries, and a hopeless task to ever bring them to a uniform standard. What it behooves us, as Canadian engineers, to do is to take such sensible and immediate action on the subject as will commend itself to the good graces of all of us, if possible, or, if not, of a great majority of those who test the manufactured article.

However, before proposing a mode of conducting such tests as will (according to the author's experience) be of practical utility to practical men, the following Table (Table II.) is presented to the Society as embodying results which have been obtained during the last two sessions, in making ordinary commercial, private, and student tests (chiefly commercial and private).

Many results have been discarded as being inaccurate, and only those are recorded here which are believed to be very close to the truth, much closer than is ordinarily obtained.

These results have been classified according to country of manufacture, and somewhat on a scale of increasing tensile strength.

Let us consider the various qualities given in their tabular order.

(*a*) *Specific Gravity.*

The average of Canadian Portlands = 3.11.

The average of English Portlands = 3.10.

The average of Belgian Portlands = 3.055.

The average of all Portlands (16) = 3.09.

It would seem advisable, therefore, to specify a minimum for Portlands of 3.10.

The samples were not dried or prepared in any way; if they were dried for fifteen minutes, according to English practise, it is probable they would go somewhat higher.

It will be noticed that the only two Portlands (?) whose specific gravities were low (Belgians Nos. 16 and 17) were both poor cements. One, No. 16, sets slowly, and the briquettes made for 4 week tests, and immersed in water after 24 hours were found sloughed down in the tanks, and had evidently run and set over again! They would not give any test to speak of. Evidently the hydraulic property, in 24 hours, was not enough to hold them together, while the other one (No. 17) failed in the blowing test. Altogether, it is doubtful whether these cements are Portlands or naturals, although sold as the former, owing to their color being gray.

It will be noticed, with satisfaction, that Canadian Portlands stand at the top in specific gravity, judging by the samples tested, which were, however, all received from manufacturers.

The specific gravity of natural cements might be placed at 2.95, although it is not so likely to be under-run, owing to the ease with which this can be obtained.

(*b*) *Water required for standard consistency.*

This is considered by many to be very important; but many tests have demonstrated to the writer that what is especially needed is that there shall be sufficient to make good briquettes; to err, say, 1 per cent. in adding water is fatal if too little, while if too much, it does not seem to affect the strength of briquettes at 1 week, certainly not at 4 weeks. This is contrary to statements often made regarding

Tensile Strength.			Compressive Strength.			Setting Quality.	
Neat.	1 to 1.	3 to 1.	Neat.	1 to 1.	3 to 1.	How determined.	How defined.
	Not yet year later.	specified, to be	reported on 1			Gilmore's needles incipient to bear $\frac{1}{12}''$ diar. ¼ lb. full set to bear $\frac{1}{24}''$ diar. 1 lb.	
1 week 300-400 1 month 480-650		3 days 110 1 week 120-220 1 month 200-350				Vicat's needles incipient set to bear 66 lbs. to not quite penetrate full set to bear up same needle.	2 hours or more slow setting, less time quick setting.
Natural 1 day 40-80 1 week 60-100 1 month 100-150 1 year 300-400 Portland 1 day 100-140 1 week 250-550 1 month 350-700 1 year 450-800	Natural 1 week 30-50 1 month 50-80 1 year 200-300	Portland 1 week 80-125 1 month 100-200 1 year 200-350				Gilmore's needles.	
		1 month 227½			1 month 2275	Vicat's needles.	Same as English.
Minimum. 1 week 285 1 month 498 3 months 640; to show 25% increase 1 week to 1 month.		Minimum. 1 week 114 1 month 213 3 months 266				Vicat's needles.	Incipient to be not less than 30′ full set to be not less than 3 hours or more than 12 hours.
		1 week 114 1 month 171					

Kind of sand used.	How put in Molds.	Rate of loading in tensile tests.	Time in air before immersions.	No. of tests used for Averages.	Time of Mixing.	Wearing Qualities.	Adhesive Qualities.
Standard crushed quartz to all pass No. 20 sieve all caught on No. 30 sieve.	10 lbs. per square inch steady pressure.	200 lbs. per minute.	24 hours.	Not stated, probably 5	1 minute for quick setting, 2 minutes for slow setting, mechanical mixer.		
ditto.	10 lbs. on briquette for 5 minutes, or shaken in molds or beaten with trowel for 1 minute.	400 lbs. per minute.	24 hours.	5	1 minute or more, mechanical mixer.		Mr. Mann. 1 week 57 } ground glass. 1 month 78 3 months 98 Fineness has great effect.
ditto.	Pressed in with trowel without ramming.	ditto.	24 hours.	5 Smallest section only.	1 minute or more, hand or mechanical mixing.		
Standard crushed quartz, ½ to pass 20, caught on 30. ½ to pass 30, caught on 38 sieves.	Bohmes' apparatus, 150 blows with trip hammer weighing 4.4 lbs.	13 lbs. per minute.	24 hours.	10	1 minute for quick setting, 3 minutes for slow setting cements.	1 to 1 and 2 to 1 give higher results than neat or 3 to 1 tough at 7 days as at 20 days.	Advised to be still reported on and investigated, to be made on ground glass.
Crushed Cherbourg quartz pass No. 20 caught on No. 30 sieves.	Filled in and tamped with rammer weighing 7 ozs. till water stands on surface.	Not specified.	24 hours then in sea water of 59° to 64° F.	6 Mean of 3 highest taken.	5 minutes by hand on a slab, temperature of air 59° to 64° F.		
				10 Mean of 6 highest taken.			

the increased strength given by a minimum amount of water; but probably what is referred to is an excess of water sufficient to make a thin batter or soup. Undoubtedly, such an amount not only makes the briquettes shrink and crack in drying, but will seriously affect the early strength.

A very peculiar effect was met with in two Canadian and one English Portlands. They were evidently fresh, and when mixed with a normal amount of water would work into a good plastic mass, but in about one or two minutes after the water was added, they would suddenly set so hard that it was useless to attempt to put them in the molds.

By increasing the per cent. of water to about thirty, a thin batter was made, which could be got into the molds before this action took place; of course this amount of water made the set very slow, and deadened the indurating action in 1 week tests.

When tests were made, several weeks later, on these cements, this effect had disappeared; perhaps some one connected with the industry can explain the cause of this action.

(*c*) *Residues or Fineness.*

The variation is enormous, as the following statement shows: —

	Residue on No. 50 Sieve. Per Cent.	Residue on No. 80 Sieve. Per Cent.	Residue on No. 120 Sieve. Per Cent.
Coarsest	31.4	52.2	61.2
Finest	0.25	2.7	6.7

The English Portlands are generally very coarse, as will be seen, and the selected Canadian ones fine.

It is not putting it too severely to say that specifying a certain residue on No. 50 sieve is a direct premium on coarse grinding, and so, in fact, are neat tensile tests.

For instance, English brands, Nos. 10, 11, 12, 13, and Nos. 14 A, 14 B, are all evidently ground to pass a specification of 5 per cent. residue on No. 50 sieve, and are all very coarse when sifted on finer ones, thus plainly showing the failure of the specification to obtain as good a product as possible.

The author would urge the severest requirements for fineness.

Various papers read and the statements of manufacturers themselves go to show that the increased cost is very slight, not more than ten cents per barrel between ordinary and fine grinding,

10 per cent. residue on No. 80 sieve }
20 per cent. residue on No. 120 sieve } as maximums are not too

high for present facilities for fine grinding; this would let in three out of four Canadian Portlands tested, one out of ten English Portlands tested, two out of four Belgian Portlands tested, or in all six out of eighteen brands. There are signs, however, that the English manufacturers are waking up to finer grinding, and will soon fall into line; there is no reason why educating influences should not bring grinding down much finer still for ordinary brands, but for the present, too much severity would defeat the object in view. (For tests on the effect of fine grinding, see Series I. of Experiments.)

(*d*) The time of incipient and final set, as found by Gilmore's needles, does not seem to affect the strength, except for very short tests. When the slow settings are generally stronger, good cements may be either the one or the other; but ordinarily, unless for tidal work, a slow setting one has the desirable feature of allowing masons

TABLE II.

CONDENSED TABLE OF CEMENT TESTS. 1893–1894.

Designation of Origin.	No. in Table.	Obtained from.	Specific Gravity.	Per cent. water for standard consistency.	Residue per cent. on Sieves				Blowing test result.	Time of setting in air.		Average Tensile Strength in pounds per square inch.									
												Neat Cement.									
					No. 20	No. 50.	No. 80	No. 120		Incipient.	Full.	3 dys.	1 wk.	2 wks.	wks.	4 wk.	2 mos.	3 mos.	4 mos.	6 mos.	1 yr.
Canadian N	1	Dealer	3.01	33	0	7.2	12.5	18.3	very good	4°00′	7°45′	78	71	....	....	124	226	....	....	....	.
Canadian N	2	Maker	2.96	33⅓	0	2.9	11.7	21.4	good	0°45′	2°45′	99	150	....	....	268	377	448	478	492	..
Canadian P	3	Maker	3.12	25½	0	1.1	14.2	31.2	good	5°00′	20°00′	125	210	....	....	359	....	....	....	....	....
Canadian P	4	Maker	3.12	26	0	0.8	2.7	6.7	good	0°37′	3°10′	335	388	....	....	525	....	....	....	....	....
Canadian P	5	Maker	3.09	25	0	0.6	5.5	13.2	good	1°00′	5°00′	278	399	....	....	459	....	....	....	....	....
Canadian P	6	Maker	3.12	24	0	0.9	6.4	13.2	good	4°30′	6°00′	438	588	....	....	671	....	....	....	....	....
Canadian P	6*a*	Dealer	....	24	0	3.0	13.6	20.7	very good	2°00′	6°30′	312	531	....	....	611	....	....	....	....	....
Canadian P	6*b*	Dealer	....	24	0	2.3	27.[illegible]	40.7	fair	....	....	300	307	....	....	....	....	....	....	....	....
Canadian P	6*c*	Dealer	....	23	0	31.4	52.2	61.2	bad	....	....	253	264	....	....	....	....	....	....	....	....
English P	7	Dealer	....	33	0	10.5	21.6	....	good	....	....	....	230	....	....	331	....	....	....	....	....
English P	8	Dealer	3.09	25	0	14.0	28.4	39.5	good	3°20′	6°30′	160	414	....	....	528	....	....	....	....	....
English P	9	Dealer	3.09	26	0	1.4	12.8	22.9	good	13′	2°00′	390	420	....	....	453	....	....	....	....	....
English P	10	Dealer	3.10	23½	0	6.7	19.2	26.5	good	25′	50′	250	386	172	....	552	....	....	....	....	....
English P	11	Dealer	3.08	23	0	4.0	14.2	23.1	good	30′	1°00′	336	477	396	....	504	560	637	627	644	....
English P	12	Dealer	3.11	24	0	4.2	19.5	28.5	good	25′	3°00′	244	362	....	....	547	....	....	....	....	....
English P	13	Dealer	3.13	24½	0	4.5	17.3	26.3	bad	20′	4°00′	335	344	....	....	422	....	....	....	....	....
English P	14	Dealer	3.13	24	0	0.25	5.0	12.9	very good	20′	2°30′	....	387	144	....	495	....	....	....	....	....
English P	14*a*	Dealer	3.12	23	0	5.6	20.9	30.5	bad	27′	3°05′	....	343	150	....	469	....	....	....	....	....
English P	14*b*	Dealer	3.05	23	0	5.3	19.7	30.1	some bad	20′	2°30′	304	309	....	....	449	....	....	....	....	....
Belgian N	15	Dealer	2.97	30	0	7.7	15.4	19.4	very good	1°00′	2°30′	154	210	....	....	285	....	....	....	....	....
Belgian P	16	Dealer	3.03	26½	0	2.2	12.4	20.6	good	5°00′	12°00′	232	332	....	....	Fl'd	....	....	....	....	....
Belgian P	17	Dealer	3.02	26	0	3.1	12.9	20.1	bad	1°10′	5°00′	328	394	....	....	487	....	....	....	....	....
Belgian P	18	Dealer	3.09	27	0	0.3	2.8	9.4	good	1°20′	4°50′	255	360	....	....	492	....	....	....	....	....
Belgian P	19	Agent	3.08	25	0	0.9	6.2	15.8	good	2°40′	7°40′	452	536	....	....	525	....	....	....	....	....
	20	....	....	25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	533
	21	....	....	25	0	4.0	10.8	....	....	....	....	....	....	....	463	....	....	....	....	....	648
	22	....	....	....		....	....	....	....	....	....	....	152	....	....	485	....	....	....	....	606
	23	....	....	....	....	....	....	....	....	....	....	....	345	450	....	545	....	....	....	....	593
Total......	....	....	..		....	....	....	....	....	....	....	....	..	....	....	....	....	....	....	....	....

Designation of Origin.	No. in Table.	AVERAGE TENSILE STRENGTH IN POUNDS PER SQUARE INCH.																				
		1 to 1.							1 1-2 to 1.	2 to 1.						3 to 1.						
		1 wk.	2 wks.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.	1 month.	1 wk.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.	1 wk.	2 wks.	4 wks.	2 mos.	3 mos.	4 mos.	6 mos.
Canadian N	1	68	....	102	125	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Canadian N	2	76	....	115	158	162	137	163	132	....	....	....	....	....	....	....	....	....	....	....	....	....
Canadian P	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30	....	72	....	....	....	....
Canadian P	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	49	....	75	....	....	....	....
Canadian P	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	43	....	92	....	....	....	....
Canadian P	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	106	....	126	....	....	....	....
Canadian P	6*a*	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Canadian P	6*b*	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Canadian P	6*c*	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
English P	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
English P	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	55	....	136	....	....	....	....
English P	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	95	....	115	....	....	....	....
English P	10	232	345	316	....	....	....	....	....	....	....	....	....	....	....	72	....	96	....	....	....	....
English P	11	192	....	204	245	253	257	531	....	151	198	189	196	189	271	....	....	....	104	....	....	....
English P	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
English P	13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
English P	14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60	79	102	....	....	....	....
English P	14*a*	....	....	....	....	....	....	....	....	....	....	....	....	....	....	54	64	90	....	....	....	....
English P	14*b*	....	....	....	....	....	....	....	....	....	....	....	....	....	....	34	....	....	....	....	....	....
Belgian N	15	134	....	195	....	....	....	....	....	48	77	....	....	....	....	....	....	....	....	....	....	....
Belgian P	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belgian P	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Belgian P	18	....	....	....	....	....	....	....	....	126	207	....	....	....	....	....	....	....	....	....	....	....
Belgian P	19	....	....	....	....	....	....	....	....	....	....	....	....	....	....	133	....	154	....	....	....	....
	20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	22	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	23	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total......		....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

to mix and use good-sized batches of mortar, without constant tempering, which is the practise with quick-setting ones, much to their own hurt.

(*e*) The blowing test advised by Faija has detected a "blowey" tendency in several instances; but much late evidence seems to throw some discredit on blowing tests, whether made with hot or boiling water, on the ground that manufacturers can, by the addition of sulphate of lime, cause the cement to be so slow setting and set so strongly as to resist the blowing tendency of so much as 3 per cent. of free lime added after the cement had been burnt. If this is a fact, chemical analysis will need to be resorted to more frequently, to detect this dangerous adulteration, which is fatal in sea-water and bad in any case, as the great strength which it gives to cements at early dates is apt to decrease at longer periods. Belgian No. 19 cement tested gave higher results at 1 week than at 4 weeks; this looks a little suspicious.

Cements have been tested usually neat; the Germans have reached the stage of three to one mixtures as the deciding test, and this would seem to be the only rational way of testing a cement, *i. e.*, in the same condition as it is used.

The difficulty, however — and it is a very serious one — has been to get anything like uniform results in sand tests. The variation in putting the mortar in the molds has been so much more than the variation in the cementing value of the cement that the tests were valueless, so that most testers have clung to neat tests as being simple and a fair index of cementing qualities. That this view is in fault and misleading, every tester will admit, and it is only partly avoiding the difficulty to specify a certain fineness, strength, and specific gravity in combination, and even then the results are not definite, as each cement is different in value. However, for those who have facilities for testing cement neat only, — and these will probably be in the majority for some time to come,— it would seem that 350 lbs. at 1 week neat and 450 lbs. at 4 weeks neat are easily obtained, and quite enough to specify. Eleven brands tested would give this much strength and stand the blowing test, and of these there are six brands fine enough for 10 per cent. residue on 80 sieve and 20 per cent. residue on 120 sieve, with a specific gravity varying from 308 to 313, while the six brands which are not strong enough are also too coarse.

Average Compressive Strength pounds per square inch.														Transverse Strength.					No. of Tests.		
Neat Cement.						to 1.			2 to 1.			3 to 1.		Neat 1″ x 1″ broken on 6″ centers.							
1 wk.	2 wks.	3 wks.	4 wks.	2 mos.	1 year.	1 wk.	4 wks.	2 mos.	1 wk.	4 wks.	2 mos.	1 wk.	wks.	1 wk	2 wks.	3 wks.	4 wks.	1 year.	Tensile.	Comp.	Trans.
				1600															27	1	0
1285			2255			900	1350												100	8	0
												205	415						33	3	0
												392	412¼						33	4	0
1302			2492											42					30	4	1
3025				4975									1025	99					35	7	2
																			15	0	0
																			6	0	0
																			10	0	0
1502			1720											54			84		10	5	2
1907			2650											73			99		30	2	5
				4500															40	1	0
							3325												29	1	0
							2826	3200			800						112		105	9	2
																			44	0	0
																			14	0	0
																			30	0	0
																			30	0	0
																			93	0	0
1250			1950						743	953									35	8	0
																			10	0	0
																			13	0	0
																			50	0	0
2970			4350									718	900						24	6	0
					6391													113	12	10	2
		5310			4826											86			17	3	2
1200	1555		2566		5066												59		13	9	2
	3000		4400															60(?)	6	2	1
																			894	83	19

The sand briquettes were lightly tamped with a small iron rammer.—*C. B. S.*

The tests on natural cements are not extensive enough to form a good basis, but it would seem easy to get 100 lbs. neat at 1 week and 200 lbs. neat at 4 weeks, and a fineness the same as for Portlands.

The tests on No. 2 natural and No. 11 Portland were carried on for 6 months, and show the natural to be gaining on the Portland, although each has evidently nearly reached a maximum. This would seem to bear out the idea which many people yet have, that, in time, a natural cement, not being so brittle, will catch up to a Portland. Long time tests are very much needed on this subject.

Natural cements being underburnt (usually) have very much less combining power with sand; the one to one natural is not as strong as two to one Portland, according to tests made last year as per Table II. in which the mixtures were made with 15 per cent. of water for one to one, and 12 per cent. of water for three to one mixtures, the mortars being lightly tamped into the mold with an iron rammer; the tests made this year, however, by means of a uniform pressure, give much higher results for one to one naturals, when 20 per cent. of water is used, which would seem to be nearer to the amount used in practise, making a soft plastic mortar. (See pressure tests.)

Natural cement has many uses. It is being passed aside in many quarters. Why? because *if immersed in water* for 1 week or 4 weeks, it will give low tensile tests. That terror of the present day, the testing machine, condemns it.

(*To be continued.*)

LIME AND MORTAR.

IN country places where lime has to be hauled a long distance, proper provision should be made for its preservation when it arrives at the works. In a damp atmosphere a cartage of ten or twelve miles may cause a load of lime to be partly slaked before it reaches its destination, and in cases of that kind, it would be better, when possible, to run it in the bed at once and finish the slaking; then nearly the full virtue of the lime may be captured. When this cannot be done the lime should be put in a dry place, and used as soon as possible. Lime should never be stored in a cellar, or in any place where it is damp, as it will lose half its virtue in a very short time in such a place, and the mortar made with it will never give satisfaction. Good live sand is a necessary requisite for making good mortar, and the contractor should see to it that such is furnished to the plasterer. Dead sand, while easy to work, never makes a good job, and mortar made with it soon rots and crumbles away from the wall. It is the silica in the sand that combines with the lime, that forms the hard, solid mortar we find on some of our old houses. Good long hair, that has been washed, should be used in the mortar in proper proportions to insure good work. Plasterers, as a rule, stint the hair in their mortar as a matter of economy, but this is wrong, and in a measure dishonest. To insure good and lasting work, the mortar should not be used until it has been made at least ten days. It will be better to stand fourteen days if conditions will permit. The best results in plaster work are obtained with well-made mortar that has been made one month or more before being used.— *Canadian Architect.*

The Masons' Department.

CONDUCTED IN THE INTERESTS OF THE MASON AND THE CONTRACTOR FOR BRICKWORK.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

NOTHING shows more plainly the change which has taken place in the methods employed in the building business than the relative importance which is now attached to a building contract, compared with the way such a document was regarded only a short time ago. It is not many years since quite extensive building operations were carried on without any formal written contract, and when one was executed contractors often went so far as to leave their copy in the hands of the owner or architect, saying or inferring that such a document was entirely unnecessary. With more active competition, however, and the gradual but steady reduction in the margin of profit, the builders began to realize that their business, in order to be carried on with success and pecuniary gain, must be conducted under well-defined conditions, and these conditions must assure for them equal rights with those of the owner. One of the first things to receive attention was naturally that of payments. Until recently, that is to say, so long as building operations involved no large amounts of money, payments on account were usually made in lump sums at stated intervals unless, as was often the case, this entire matter was left in the hands of the architect. But now that it is by no means uncommon for a building contract to involve hundreds of thousands of dollars, the builder finds that his payments on account must be made with regularity, and must also somewhere nearly equal the amount which has been expended for labor and materials up to the time the payment is made. This demand on the part of the contractors has led to the system, now quite universally adopted on all work of importance, of making monthly payments equal to a certain per cent. of the amount expended, the balance being held until the completion of the work. When this system was first adopted it was usually customary to pay on account seventy-five per cent. of the value of work done and materials furnished; but there has been a constant tendency to increase this percentage, and at the present time eighty per cent. is the usual proportion, although often eighty-five, and sometimes ninety per cent. is paid. The method which has been employed to a considerable extent in the past of making payments dependent on the completion of certain stated portions of the work (as. for example, so much when the foundation is in, so much when the roof is on, etc.,) is now seldom used except on comparatively small contracts, such as country houses. The result which this method sought to accomplish, namely, that of making an incentive for the prosecution of the work with all reasonable diligence and dispatch, is accomplished now by other means. Another matter practically a part of the question of payments, which has received the consideration of the contractors, is the amount that it is just and proper to retain after the completion of the work in order to secure the owner against liens or such imperfect work or materials as time alone can develop. The retention of from fifteen to twenty-five per cent. of the amount of a contract, especially if it be a large one, for an indefinite period is often a serious matter for the contractor. The difficulty of final settlement is, moreover, further complicated from the fact that it is practically impossible to determine the exact time at which a building may be said to be completed. And there are often certain things of minor importance at the end of a piece of work which the general contractor is prevented from finishing on account of delay or default on the part of the owner or architect. It seems hardly fair in cases of this kind, which are of frequent occurrence, that the contractor should be kept from receiving the greater part of the final payment to which he is usually justly entitled. But it often happens that the contractor has to wait an unreasonable length of time for his settlement, on account of some whim of the architect or the desire of the owner to save interest. What seems to be a fair and satisfactory solution of this difficulty is suggested by the English practise, where the contractor receives all but a small percentage of his final account thirty or thirty-one days, as the case may be, after the completion of the work, and the amount retained after this payment, usually about five per cent., is held from six months to a year longer as an assurance that any minor defects which may develop in that time will be made good. This method, while it inflicts no financial hardship on the contractor, assures the owner that such matters as leaky roofs, defective joints in plumbing, uncalled for shrinking or swelling of finish, and the like, will be promptly and properly attended to. As things are now, it is seldom possible, after the final payment has been made, to get the contractor to pay any attention to such defects, and as a result of this the various guarantees which appear in the specification are of little or no practical value. Besides the all-important matter of payments there are many other features of a building contract which are of consequence to the contractor. Until within a few years each architect used his own form, and, of course, no two were alike. Under these conditions a builder seldom knew the requirements under which he would be expected to execute a piece of work if the contract should be awarded to him, and in many instances he thoughtlessly signed a document, the provisions of which turned out to be manifestly unfair. It was to secure a regularity of practise in this respect that a joint committee of the American Institute of Architects and the National Association of Builders, after considerable labor, agreed upon a form now known as the Uniform Contract, which both associations recommend for general use to their members. While this form of contract is admirable in most respects, it bears in some degree the marks of compromise, and is, of course, unfitted for large public work or work which is to be executed under peculiar conditions; but in spite of minor defects, it is a form which can be used to advantage in all ordinary cases, and its use has now become quite general among the best practitioners. The strongest argument used by builders in favor of the adoption of the Uniform Contract, namely, that when a contractor signs this form of contract he knows exactly what it means, is not as strong as it first appears, for this reason: Attention has been already called to the fact that the specifications are virtually a part of the contract, and it is consequently a simple matter in the general conditions to extend or supplement the provisions of the contract so as to make the conditions under which the work is to be executed just as unfair or unjust to the builder as if the objectionable paragraphs were contained in the contract itself. And in point of fact, if the owner or architect is inclined to indulge in sharp practise, the place where he will naturally put his objectionable requirements is not in the contract, where they will be practically sure to be seen and questioned, but in the general conditions, which, as has been already stated, are seldom read, and still more rarely considered, and are, furthermore, apt to be entirely forgotten at the time the contract is signed, which serves to emphasize the importance of a complete understanding on the part of the contractor of this portion of the specifications. The production of the Uniform Contract is an important step in the right direction, but the joint committee should go farther and frame a uniform set of general conditions, leaving the purely descriptive part of the specifications to be written as occasion demands. And, furthermore. if this suggestion can be carried out, it will tend to simplify matters, as now many provisions are duplicated, being both in the general conditions and the contract, and often the requirements of these two portions of the agreement are contradictory.

It may be of interest to note that "A Form of Agreement and Schedule of Conditions for Building Contracts," issued by the Royal Institute of British Architects, seems to be compiled on the plan suggested above. What are called the "Articles of Agreement" occupy the first page and contain first, the date, the owners' and contractors' names, and the identification of the drawings and specification; then follows the amount of the consideration which it is stipulated shall be paid under the conditions which follow; then comes the identification of the architect, and lastly the provision that "the said conditions shall be read and construed as forming part of this agreement, and the parties hereto will respectfully abide by and submit themselves to the conditions and stipulations, and perform the agreements on their parts respectfully in such contained." This agreement, which contains only five paragraphs, the parties sign. The following pages contain thirty-two paragraphs, entitled "Schedule of Conditions," which appear to comprise what might be called the subject matter of our ordinary building contract and the general conditions of the specification combined in one document. The adoption of some such form as this would tend to still further simplify the relations between architects which the adoption of the Uniform Contract has already accomplished to a considerable extent.

(*To be continued.*)

THE INDIVIDUAL RESPONSIBILITY OF THE CONTRACTOR. II.

BY D. B. GARNSEY.

THE average contractor in the building trades complains bitterly of the conditions to which he is obliged to submit in order to obtain work. He considers the manner in which he is required to estimate upon and compete for work to be damaging and one-sided. If he is a general contractor, he objects, for example, to being required to assume sub-contracts without extra compensation; if he is a sub-contractor, he objects to being "placed" with a general contractor, and thereby made dependent upon the latter for his money; and both believe that they are required by custom to contend against numberless practises that operate to obstruct the transaction of business and to restrict or extinguish legitimate profit.

Contractors have so long accepted the conditions of which they complain as being inevitable, that they believe they are compelled to secure their profit within the operation of the conditions complained of, and it is rare indeed that their complaints and objections are ever heard by the persons to whom they should properly be made. The average contractor believes his position as an individual to be so weak that he dare not demand those conditions which he deems equitable; for, arguing from his own methods, he is certain that, should he decline to accept the conditions under which alone a contract would be awarded, there are many others who would not hesitate at the conditions to which he objects.

Believing himself helpless, therefore, he submits without protest to the conditions to which he secretly (so far as the other party to the contract is concerned) objects, and seeks to conduct the work by such means as will insure a profit, but convinced at the outset that he is submitting to unfair requirements. There is another sort of contractor frequently to be met with: the man who has been bred to the business under existing customs, and who is so imbued with the spirit by which they are permeated that he does not know when conditions are equitable and when they are not; and who deems unfair only such requirements as seem to prohibit profit under the methods and practises to which he is accustomed.

However well informed privately an owner may be of the exactions required of the contractor, he is seldom brought face to face with the contractor's side of the question; and it is but natural for him to assume that if the contractor is contented with the situation, he (the owner) is not under obligation to point out those conditions by which the cost of the building is reduced at the contractor's expense. The owner generally accepts the opinion of his architect as to the requirements of competition and contract, and the architect, anxious to produce a building for his client as cheaply as possible, discounts his knowledge that a contractor can be readily found who will perform the work under any conditions however damaging, and exacts such requirements as he sees fit.

The fact that the building business is daily conducted under conditions entailed by improperly conceived and imperfectly sustained relationships existing between contractor, owner, and architect is no reason why it should continue to be conducted under such conditions. It would be idle to attempt to lay down a hard and fast course of procedure for the elimination of the conditions complained of, with the expectation that even if they were perfect they would be adopted, or that even the value of that adoption would be understood. The cupidity of the individual prevents concerted action by the mass; and the diversity of men's minds prevents concerted action by even a sufficient majority to dislodge from their foothold injurious conditions that are the result of years of acquiescence. It is only by steadily instilling into men's minds a knowledge of their own responsibility for the conditions of which they complain, until that knowledge shall have become sufficiently full to beget action, that inequitable customs may be transformed and the business conducted upon an approximately just and profitable basis. The average contractor must be made to understand that, no matter who was responsible for the birth of the customs to which he objects, he, and he alone, is responsible for their perpetuation. He must be made to say, with conviction of its truth: "If I submit to the requirements of this competition or this contract, I admit their justice, and have no cause of complaint; and by my action I advertise to those with whom I have business dealings that I will give away at least a part of my rights in order to secure work."

As it is a fact that there are certain contractors who decline to submit to unfair requirements and still are able to conduct their business profitably, so it may become a fact that those inequalities existing in the building business may be steadily reduced until they reach the minimum; but that minimum will never be reached so long as the contractor does all his complaining and protesting where it will produce not the smallest result. Unjust requirements must be pointed out to those who seek to exact them, whether owner, architect, general or subcontractor, and the protest should be a manful, business-like statement of fact. Persistent effort alone will produce results, and it is self-evident that customs which are the outgrowth of years of neglect cannot be wiped out in a day, or by the breath of purposeless and ill-directed "kicking."

The contractor is one party to a relationship that should be just; and when he yields some part of the profits which should accrue to him from that relationship, he confers upon the other party an excess of profit to which he is not entitled. Long-standing custom, the *present* competitive system (?), and the contractor virtually constitute a conspiracy to defraud the contractor for the benefit of his patron. That many contractors attain financial success has no bearing upon the fact that, however equitable the competitive system may be in theory, in practise the system is so badly administered that the contractor suffers under its operation, and for that suffering is largely, if not solely, to be blamed. Being the seller in a competitive market, he undersells himself.

WHAT IS THE PROPER METHOD OF CONSTRUCTING A BRICK CISTERN?

EDITOR THE BRICKBUILDER.

Dear Sir: — Will you or some of your correspondents having knowledge of the subject give me information as to the best method of constructing a brick cistern, 12 ft. in diameter and 12 ft. deep, the bottom to rest on sandy soil? I find expert opinions differ as to the thickness of the walls, the proportion of cement to be used, and especially as to whether the foundation would better be constructed of three courses of brick, with an inverted arch for the bottom, or flat, with 12 ins. of good concrete, two parts cement, one part sand, and four parts clean broken stone. Opinions seem to agree that the vertical walls should be at least 12 ins. thick.

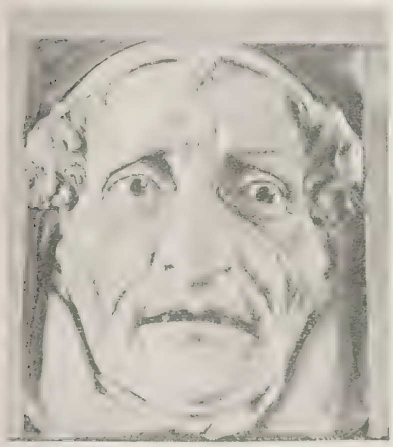
Yours truly,
46 Cedar St., New York City. F. C. MOORE.

[We should be glad to hear from any of our readers who have a theoretical or practical knowledge on this subject. — ED.]

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

CHICAGO. — Architects say that all work on their boards is stopped awaiting the election; and that really is the status of affairs here.

By referring to the files of THE BRICKBUILDER, a record can be found of the time of beginning two projects: one, the new post-office for the government; the other, the new Illinois Trust and Savings Bank Building. The former had the start, but before the roof of the old post-office was completely torn off and razing of walls was begun, the old Grand Pacific Hotel had disappeared, new foundations went in, walls appeared, and now steel work for the first floor is in place. While the government officials were talking about letting a contract to remove the old post-office building, plans were being made for a large hospital. The latter (Alexian Brothers' Hospital) is now up three stories, and has just been the object of a notable ceremony by twenty-five thousand Catholics. It will be interesting to see how long these two important buildings will be occupied before the government building is fairly started.



TERRA-COTTA BRACKET, MABLEY BUILDING, DETROIT.
D. H. Burnham & Co., Architects. Made by Northwestern Terra-Cotta Company.

Another institution lately dedicated to public use is the Lewis Institute, which, like Armour Institute, is destined to become a great technical and manual training school.

Of buildings now approaching completion, of particular interest to brick and terra-cotta lovers, one is the Trude Building, illustrated in the last issue of this journal. The entire exterior is of a pleasing yellow-colored brick and terra-cotta. In striking contrast with the Trude in the matter of color and design is the new Silversmiths' Building, drawings of which I hope soon to send for illustration. It has a rich mottled, dark-green, glazed terra-cotta for the lower stories, with red brick and terra-cotta above.

One of the first buildings designed by H. H. Richardson in Chicago was the Monroe Street office building of the American Express Company. The mansard roof has recently been changed under the direction of Jenney & Mundie into some additional stories. Another building of importance to be altered is the Royal Insurance. The same architects are working on the drawings, which provide three additional stories.

Holebird & Roche have planned an elaborate entrance for Graceland Cemetery. The material used will be granite.

W. A. Otis has made plans for a church at Woodlawn and 57th Street.

The Chicago Architectural Club has just elected for its president, Mr. Richard E. Schmidt, who designed the Alexian Hospital mentioned above. Mr. George R. Deane, the retiring president, is serving as an instructor in the architectural department of the Art Institute this year. The club is in a prosperous condition considering the times, and looks forward to a prosperous year.

ST. LOUIS. — Energy and persistent determination have removed almost all evidence of the tornado of last May, save that found in the parks and streets, where the trees were destroyed, and the results have far exceeded anything thought possible by even the most vivid dreamer who may have visited the scenes of destruction on the following morning.

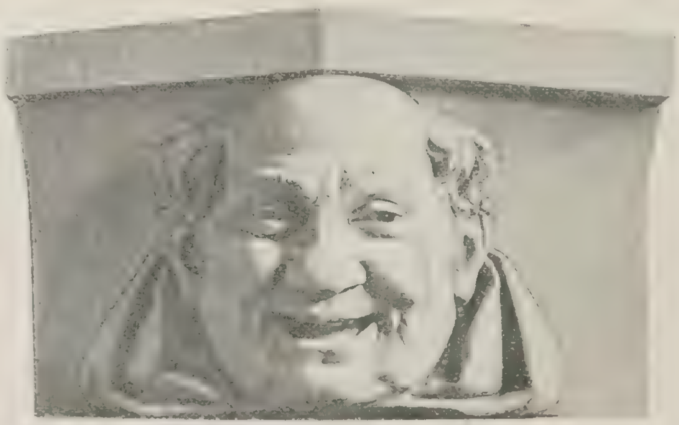
MADE BY THE NEW JERSEY TERRA-COTTA COMPANY, FOR OFFICE BUILDING, 585 BROADWAY, NEW YORK.
Cleverdon & Putzel, Architects.

Around Lafayette Park, the most aristocratic neighborhood on the south side, and where one would naturally expect a return to natural conditions sooner than elsewhere, the least progress has been made toward rebuilding; although it is believed that even here, in a very short time, there will be little left to remind us of the great disaster. Several of the churches have been rebuilt. The Union Club is rebuilding, and a movement is on foot to rebuild Anchor Hall.

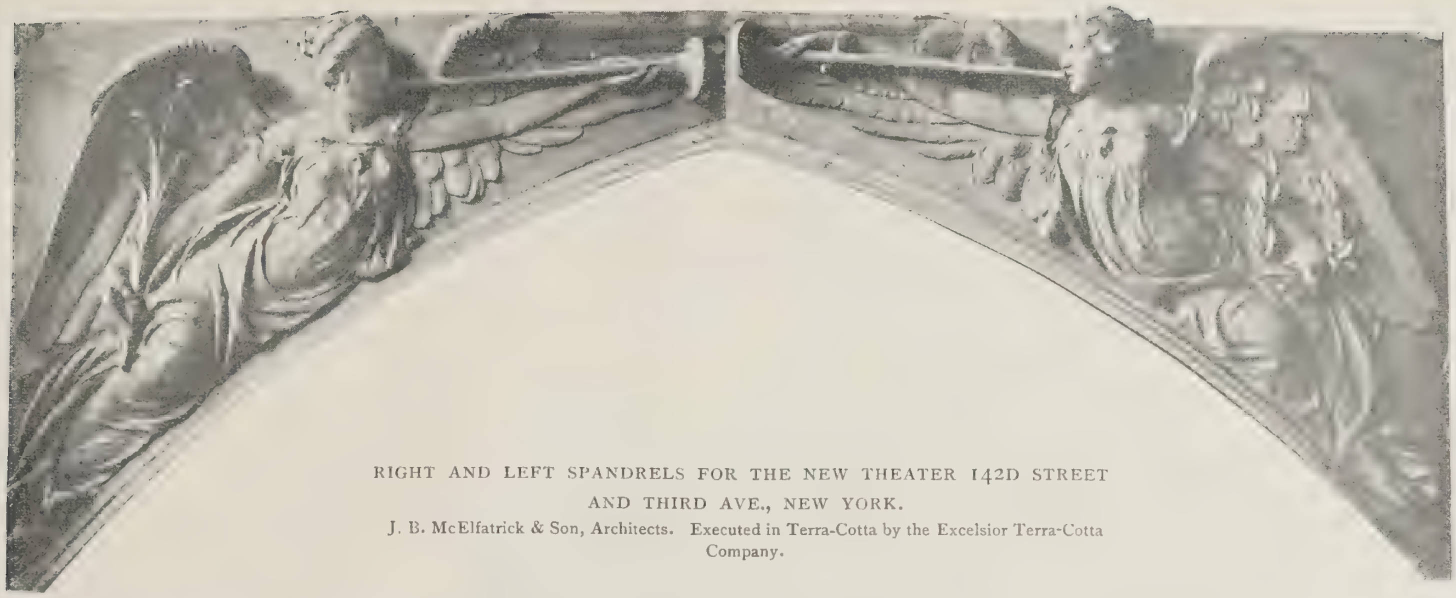
Even though the loss of property and life was great, we cannot say that there have been no good results, for, besides the benefits that have accrued to the workingman by creating a demand for his labor that would not have occurred otherwise, the owners have, in many instances, put up new buildings, better arranged, provided with more modern sanitary appliances, and having less offensive exteriors.

There has also been a general awakening of the spirit of progress among the south side people, and new enterprises are springing up on all sides.

The Drummond Tobacco Company recently completed a 100 ft. six-story addition to their factory, besides adding an additional story to the entire old building, which adds very materially to its appearance. Usually, the adding of another story to a building adds nothing to its



TERRA-COTTA BRACKET, MABLEY BUILDING, DETROIT.
D. H. Burnham & Co., Architects. Made by Northwestern Terra-Cotta Company.



RIGHT AND LEFT SPANDRELS FOR THE NEW THEATER 142D STREET AND THIRD AVE., NEW YORK.
J. B. McElfatrick & Son, Architects. Executed in Terra-Cotta by the Excelsior Terra-Cotta Company.

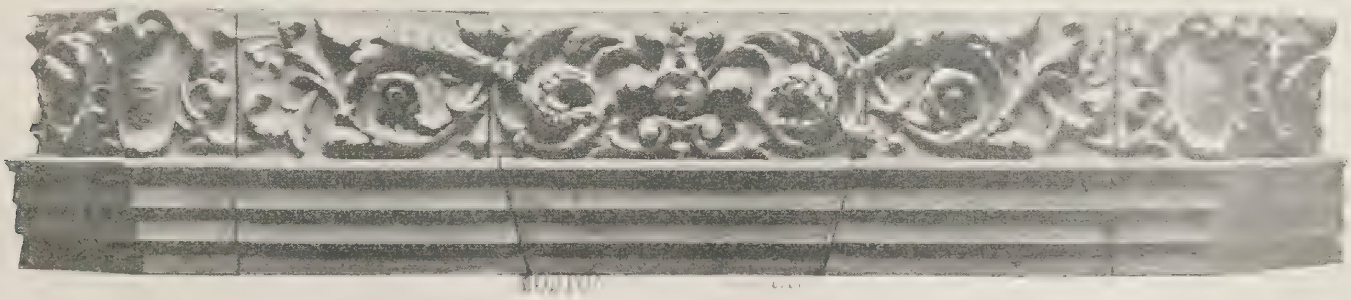
architectural appearance, but in this case the extending of the old piers through the upper story and crowning them with caps and a neat brick cornice has produced very desirable results.

The Louisville & Nashville Railroad has for some years taken especial interest in the shipping of fruits and produce, and passing through the great fruit-producing fields of the South and its connection with New Orleans and Mobile has given it an advantage over many of its competitors.

In order to handle the freight quickly and get it into the hands of the produce men at a minimum cost, it has expended $475,000 in building a produce exchange. The building is located at the Louisville & Nashville yards, and has a frontage of 400 ft. on Broadway, with a like amount along the railroad, and 100 ft. along Cass Avenue. Along the rear is a wide platform, and this, together with the entire sidewalk in front, is covered with a glass roof supported on iron cantilever trusses. The buildings have electric elevators, etc., and arranged so that freight can be transferred directly to or from the cars to the building.

Business continues dull with little encouragement for any fall or winter work, although every one is hopeful that there will be something more to do after the election.

PHILADELPHIA. — As in other cities, the building situation is exceedingly dull, with a prospect of quite a rush immediately after the fall elections have instilled confidence into financial circles; there are a number of projects, both public and private, which are to go on at once to completion if confidence will again be restored; meanwhile, the few large buildings which have been in course of construction for a few months past are being pushed to completion.



WINDOW LEAD, FOR RESIDENCE AT PHILADELPHIA.
Baker & Dallett, Architects. Executed in Terra-Cotta by the Conkling-Armstrong Terra-Cotta Company.

The buildings of the Girard Estate, the S. S. White Dental Manufacturing Company, Baptist Publication Society, Thackara Building, etc., are being hastened forward, while several which were intended to be built upon the square surrounding the City Hall have apparently been abandoned.

The steel frame for the Girard Building is worthy of note. It is made by the Pencoyd Company, and the very substantial appearance of it is in marked contrast with some of the others which have gone up under our eyes in the last few years; it appears that the dangers of vibration and wind strains, which were formerly thought very lightly of, are being seriously considered by architects and engineers of to-day; this frame is exceedingly and exceptionally well constructed, and the bracing of it is very interesting to note.

Quite an unusual transaction in connection with the contract for the new First Methodist Episcopal Church, Main and High Streets, Germantown, is worth mentioning, especially since the editors of this and other journals have been trying to convince the public that stone is better than terra-cotta, and *vice versa*. In this case the building was designed by Architects Rankin & Kellogg in the Perpendicular Gothic style of architecture, the body of the work was to be of Chestnut Hill local stone, and the trimmings, which were very elaborate and ornamental, were to be of gray terra-cotta.

In connection with the successful bid of Contractor Charles P. Nesbitt, of Philadelphia, was a proposal of a local stone-cutter, Mr. Reily, in which he offered to build the structure as designed by the architects, substituting Indiana limestone for the ornamental terra-cotta, and Holmesburg granite for the Chestnut Hill local stone, at a price which was several hundred dollars less than that asked by the terra-cotta companies. Mr. Reily's bid was accepted, and the original design is being carried out in stone instead of terra-cotta.

It appears from this transaction that either the price of cut stonework is to-day very much lower than formerly, or the terra-cotta companies, "in the exuberance of their zeal," are charging too much for their product.

October 5 witnessed the formal opening of Horticultural Hall on South Broad Street; Frank Miles Day & Brother, architects; a description of which has been given in previous letters. This is undoubtedly one of the finest of the recent brick and terra-cotta buildings of this city, and lovers of good architecture will not soon tire of examining its exquisite design and detail work; it is an excellent example of Italian Renaissance, and its far overhanging roof of tile, treated in beautifully harmonizing color underneath, is generally admired.

MINNEAPOLIS.— The prospects are that we shall have a busy season beginning with the early spring, providing the pending election restores confidence in business circles. This estimate is based on the fact that much work has been planned but laid over until after this all-important event. In addition to this, there is much new work already being talked of. The finishing up of old work and the building of band-stands and grand-stands for the accommodation of the Grand Army Encampment, K. of P. Conclave, State Fair, and numerous other events (all of which have brought many visitors to our city) has given us the appearance of being very busy.

Two very substantial business blocks (one for the North Star Boot & Shoe Co., the other for the Wyman-Partridge Co.) are now being erected on opposite corners of one of our principal thoroughfares. Both of these buildings will be seven stories and fire-proof.

It is reported that the reorganization of the Northern Pacific Railway Company means a new union depot for Minneapolis,— certainly we need one.

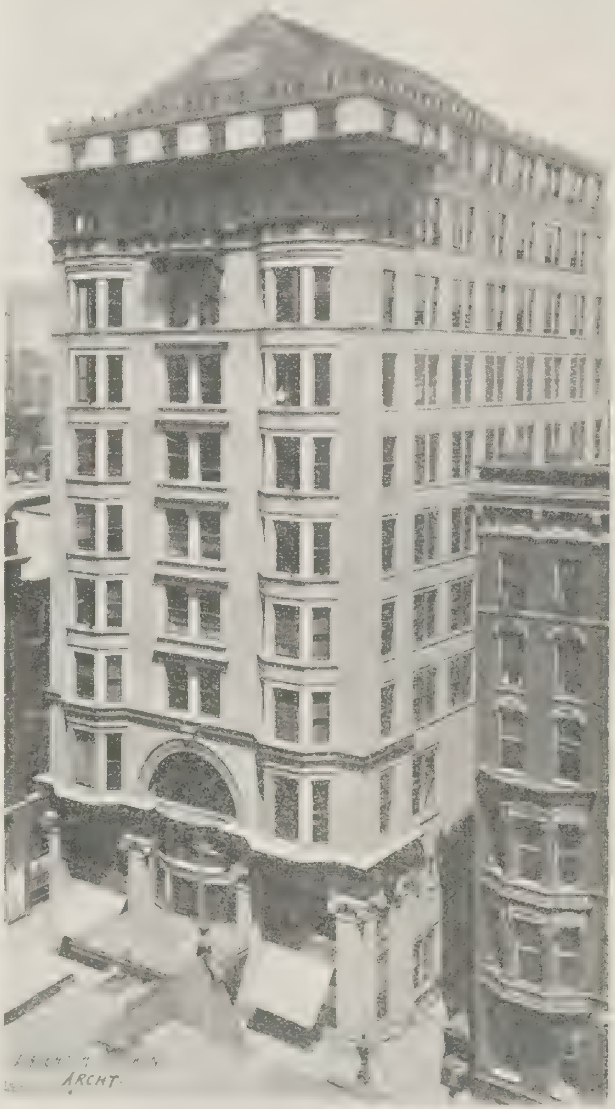
W. H. Hayes, of this city, is architect for a Methodist Episcopal Church at Pekin, China, to cost $75,000.

ST. PAUL.— Practically the same state of affairs prevails here as at Minneapolis. Aside from a few large enterprises, there is comparatively little doing.

Architect Cass Gilbert, at regular monthly meeting of the Minnesota Chapter A. I. A., gave a detailed account of his experiments with cements and concreting for both the new capitol and the Northern Pacific Railway Company's new office building. He is making a series of exhaustive tests, which will furnish valuable and conclusive data for the future, not only as to methods, but also as to relative worth of various cements of domestic manufacture, several of which proved themselves worthy of entire confidence for every purpose. Mr. Gilbert is also testing three different methods of floor construction.

Mr. Gilbert secured second prize of $1,500 in the Montana Capitol Competition.

Evans & Howard will furnish the face brick for the New Northern Pacific office building.



BOSTON PU.

STEINWAY HALL, CHICAGO.
Dwight H. Perkins, Architect.

PITTSBURG.— Among the contemplated work in this city may be mentioned that Architects Alden and Harlow have prepared plans for two of the branch libraries, one to cost $30,000, and the other $15,000. Plans are being prepared for a two-story granite and brick bank building for the Western National Bank, corner of Penn and 9th Streets. Architect Chas. Bickel has prepared plans for an eight-story stone, brick, and terra-cotta warehouse to be erected at the head of Federal Street on Fifth Avenue, to cost about $8,000. It will be constructed on the slow combustion principle. Architect E. C. Tritten, of Philadelphia, is preparing plans for a $30,000 two-story brick and terra-cotta school building in the East End. The Turtle Creek School Board have decided to build a schoolhouse to cost about $24,000. Architect S. Munch is preparing plans for a brick and stone club-house for the East End Republican Club. Architect V. Wyss Thalman has prepared plans for a dwelling to be erected on Linden Avenue, East End, for Mr. Richardson, to cost $10,000. Work has commenced on the $100,000 residence of Mr. A. M. Byers, of Allegheny. E. M. O'Neil is having built at Oakland forty three-story brick and stone dwelling-houses to cost $100,000.

ROCHESTER. — Building operations are "waiting until election's over," and as a result local architects are not busy.

Architect J. Foster Warner has let the contract for the erection of a $100,000 extension to Sibley, Lindsay & Carr's wholesale building; W. H. Gorsline has contracted for masonry. Same architect has prepared plans for a fine railway station to be built on Court Street for the Lehigh Valley Railway Company. He is also making plans for another for the Buffalo, Rochester & Pittsburgh Railroad. It is understood that both will be large and costly structures.

COLOR *vs.* DURABILITY.

FROM the architect's point of view, nothing is of greater importance in selecting bricks and terra-cotta than an even and uniform color. No matter how durable the materials may be, he will not select them unless they are of a good tint. That is, of course, well known to all clayworkers, and in order to fulfil the necessary requirements the maker does his utmost. But the time has now arrived when architects of the younger school are asking themselves whether in addition they ought not to demand something of a durable nature. They are also considering the question as to what constitutes a good color in the artistic sense. It is impossible for the manufacturer to put up with every little whim of the architect, but a strong feeling obtains at the present time that something should be done to improve the durability of the materials as well as to produce new tints. — *The British Brickbuilder.*

PLATE ILLUSTRATIONS.

PLATES 55, 56, 57, 58, 59, and 60 show the three lower and three upper stories, also the stage elevation of Steinway Hall, Chicago, Dwight H. Perkins, architect. It has a frontage of 61 ft., and is 91 ft. deep, surrounded on three sides by alleys, giving light all around. It is built to house the musical public. The first story is a piano salesroom occupied by the Steinways of New York. The second and third stories are one; they constitute the hall. It is arranged for chamber concerts, will accommodate an orchestra of forty pieces on the stage, has a grand organ of fifteen hundred pipes, and will seat 750 people. The hall is elaborately decorated. The frieze over the arch is from Norse mythology, and represents the Death of Balder or the Passing of Summer. The fourth and fifth stories are piano salesrooms similar to the first.

The sixth, seventh, eighth, ninth, tenth, and eleventh are divided into music studios, singly and *en suite*, all especially arranged for their peculiar uses. On the seventh floor is a recital hall seating 250, and arranged for dramatic study and amateur performances.

The structure is steel covered with fire-clay tile and faced with pressed brick and terra-cotta. The front is in three shades of buff, — dark at the bottom, medium above — light for the shaft, and medium for the top or cornice story.

The architectural terra-cotta used was furnished by the Northwestern Terra-Cotta Company, while the front brick was supplied by Charles T. Harris.

Plate 62 shows the front elevation of the Loder Building, Philadelphia, Penn., erected after the plans of Mr. Charles Balderston, architect, Philadelphia, Penn.

The two fronts on Chestnut Street and 16th Street are built of mottled Pompeian bricks, furnished by O. W. Ketcham, the Philadelphia agent of B. Kreischer & Sons, New York.

The terra-cotta was made to match Indiana limestone.

This building contains a store occupying the entire first floor and five stories of offices, which can be used either singly or *en suite*.

A new feature in store interiors is the mezzanine floor or gallery, running around the store proper 9 ft. above the floor, thereby increasing the floor area greatly, and at the same time retaining the ceiling height at 18 ft. 3 ins.

Every attention has been given to make this building one of the most complete and thorough office buildings of its size in the country.

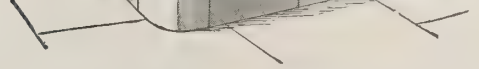
This building, considering the extremely narrow lot available, is an uncommonly successful specimen of the Renaissance, and Mr. Balderston is to be congratulated upon solving the problem in so neat a manner.

The general contractor for the building was Harrison C. Rea.

The masonry and bricklaying work was done by William R. Chapman & Sons.

THE accompanying illustration is of an enameled interlocking tile made by the American Enameled Brick and Tile Company, 14 East 23d St., New York, which is especially suited for interior finish work.

The brick or tiles are all grooved along the top and bottom edges; the walls of the lower groove being of even length, while the inner wall of the upper groove is shallower than the outer one. This allows the outer joints to be laid close, and at the same time leaves space enough between the inner walls for a nail which may be driven at any point within the length of the tile where the same crosses a horizontal or vertical joint of the wall behind.



In bedding the tile, the cement seizes the nail and fills the groove, bonding all together and to the wall. Should the nail not drive as intended, it can readily be bent in the direction of the groove, and thus tend to hold it even more firmly.

The tiles are made to lay as standard English size brick, viz., 3 by 9 in. face, and being but 1¾ ins. thick save 2¾ ins. of needless brickwork wherever it is not necessary that enamel brick of 4½ ins. thickness be used to carry a load.

No. 12 wire nails, 1½ ins. long, are recommended for brickwork backing. Screws or shorter nails can be used where tiles are set as lining over wooden partitions to give the effect of an enameled brick wall, thus economizing materially in space as is often desirable in halls and vestibules, the gain being 3 ins. wherever thus used. Owing to the secure bond between the tiles effected by the cement tongue in the double groove, it is not necessary to nail each individual tile.

Internal and external bullnose and quoins are supplied for corners, and they are rabbeted to the tile as shown in cut, thus bonding one with the other to an intimate whole, and making displacement impossible except by fracturing the tiles. Special moldings for top of wainscoting, fastened in a similar manner, are also furnished.

WHAT OTHERS ARE DOING.

WALDO BROTHERS have closed contracts for each of the three new sections of the Subway. Alsen's cement will be used, as on most of the other sections.

J. MAIR STAVELEY has been appointed New England agent for the Oliphant & Pope Company, manufacturers of face brick, Trenton, N. J.

THE UNION AKRON CEMENT COMPANY, Buffalo, are furnishing the Akron Star Brand Cement for the concrete foundation for paving at Binghamton, N. Y.

THE DONNELLY TERRA-COTTA COMPANY, Berlin, Conn., will furnish the terra-cotta for the Young Men's Christian Association Building, Norwich, Conn., C. H. Preston, architect.

J. MAIR STAVELEY, agent of the Donnelly Terra-Cotta Company, has removed to 40 Water Street, Boston. In addition to architectural terra-cotta, Mr. Staveley carries a full line of face and common brick.

WALDO BROTHERS have closed a contract calling for about thirty thousand barrels of Brooks, Shoobridge & Co. English Portland cement, to be used on the piers for the new Charlestown (Boston) bridge, although the price was higher than on other brands.

CHARLES T. HARRIS, Lessee Celadon Terra-Cotta Company, is furnishing the roofing tile for the residence of D. J. Hubbard, Chicago, John P. Long, architect; the new Music Hall, Northwestern University, Evanston, Ill., W. A. Otis, architect; and the park shelter, Prospect Park, Brooklyn, Parfitt Bros., architects.

PERTH AMBOY TERRA-COTTA COMPANY, through Waldo Brothers' agents, have closed contracts for the Drexel House, Philadelphia, Peabody & Stearns, architects; Pope Building, Boston, Peabody & Stearns, architects; Proctor Building, Fulton Street, Boston, Winslow & Wetherell, architects; Bank Building, Newton, W. G. Preston, architect.

THE WHITE BRICK AND TERRA-COTTA COMPANY has just completed the terra-cotta for store and loft, 51 West 3d Street, New York City, L. Korn, architect; residence for P. Tiffany, at Westbury, L. I., W. J. Wallace, architect; and addition to Grammar School No. 75, C. E. J. Snyder, architect, and has closed the following contracts: State Normal School, Jamaica, L. I., J. G. Perry, architect; Court Exchange Building, Bridgeport, Conn., C. P. H. Gilbert, architect; residence at Newburgh, N. Y., Charles W. Romeyn, architect; storage warehouse, Brooklyn, J. G. Glover, architect; and apartments, corner 21st Street and Ninth Avenue, New York City, C. P. H. Gilbert, architect.

The Brooke Terra-Cotta Company, Lazearville, W. Va., will furnish the buff brick used on the exteriors of the new Forsyth County Court House, at Winston, N. C., the new Court House at Charlotte, N. C., and the Court House at Wayne, N. C. A handsome residence has just been completed at Pittsburgh, Penn., in which their dark buff rock-faced ashlar was used. This same material will be used in a new residence being erected at Norfolk, Va.

This company is making a specialty this year of what they are pleased to term their No. 5 buff pressed brick, which is an especially fine light buff brick well suited for public institutions, churches, schools, and other large buildings.

The Berlin Iron Bridge Company, of East Berlin, Conn., notwithstanding the general distress among manufacturing concerns, report that their plant is fairly well employed. At no time during the year have they run on short hours, and are now employing four hundred men, running ten hours six days a week. They have contracts on hand to keep their plant employed on full time for the next two months. Have no very large contracts on hand at the present time, but a great deal of small work. Some of these may be mentioned as follows: —

For the L. D. Brown & Son Co., Middletown, Conn., fire-proof power plant and also a new dye-house; steel framework for the Fire Department Building at Worcester, Mass.; power station for the electrical equipment of the N. Y., N. H. & H. R. R., at Stamford, Conn.; machine shop for the Baush & Harris Machine Tool Company, of Holyoke, Mass.; new building for the Woonsocket Electric Machine & Power Co., of Woonsocket, R. I.; new steel bridge for the town of Green, Me., including a second bridge for the Cabot Manufacturing Company at Brunswick, Me.; and smaller bridges at Auburn, Pembroke, Turner, Buckfield, and Bridgeton, Me.; a new iron roof for Randolph & Clowes, Waterbury, Conn.; steel bridge for Somerset Company, N. J., located at Finderne, besides other smaller contracts.

BRICK AND MORTAR.

THE employment of bricks for building purposes is of the greatest antiquity, and although the building materials used in the great edifices of Babylon may seem mean as compared with those employed in the stupendous palace-temples of Egypt, and even in the less massive edifices of Assyria, yet the Babylonians appear to have raised, with them alone, structures which excited the wonder and admiration of the most famous travelers of antiquity. The profuse use of color and the taste displayed in its combination added a charm to their gigantic beauty. The palaces and temples, as those of Nineveh, were erected on lofty platforms of brickwork. The bricks, as in Assyria, were either simply baked in the sun, or were burned in the kiln. The latter are of more than one shape and quality; some are square, others are oblong; some are of a dark red color, and others of a light yellow.

The Babylonians availed themselves of the building materials found in their locality. With the tenacious mud or clay of their alluvial plains, mixed with chopped straw, they made bricks, whilst bitumen and other substances collected from the immediate neighborhood furnished an excellent cement.

In modern brickbuilding the art seems to have attained the highest perfection, and nothing beautifies a brick front more than the use of tinted mortar, which may be prepared by using the AMERICAN SEAL Mortar Colors — made in four beautiful tints. The additional cost is but trifling, and gives the work a far more artistic appearance. William Connors, of Troy, N. Y., manufactures these goods, which have a large and increasing sale throughout the United States.

No known material is more suitable for a building than brick, and when bonded with stone makes the most durable structure known to the art.

The AMERICAN SEAL Mortar Colors are shipped F. O. B. from New York City, Chicago, St. Louis, and Troy, and the branch houses are located at 99 Peck Slip, New York City, 243 Lake St., Chicago, and 407 North 12th St., St. Louis. Manufactured at Troy, N. Y.

The best and most attractive

FIREPLACE MANTELS

Are those made of our ornamental brick.

They are far better than other kinds, and don't cost any more.
Any good brick mason can set them up.

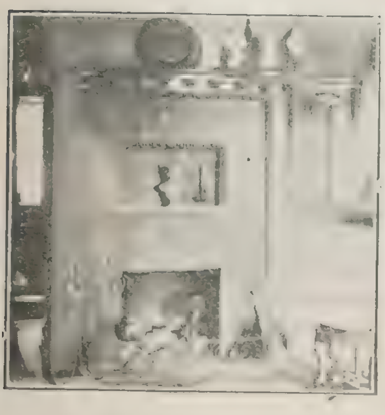
We offer a choice of six colors at

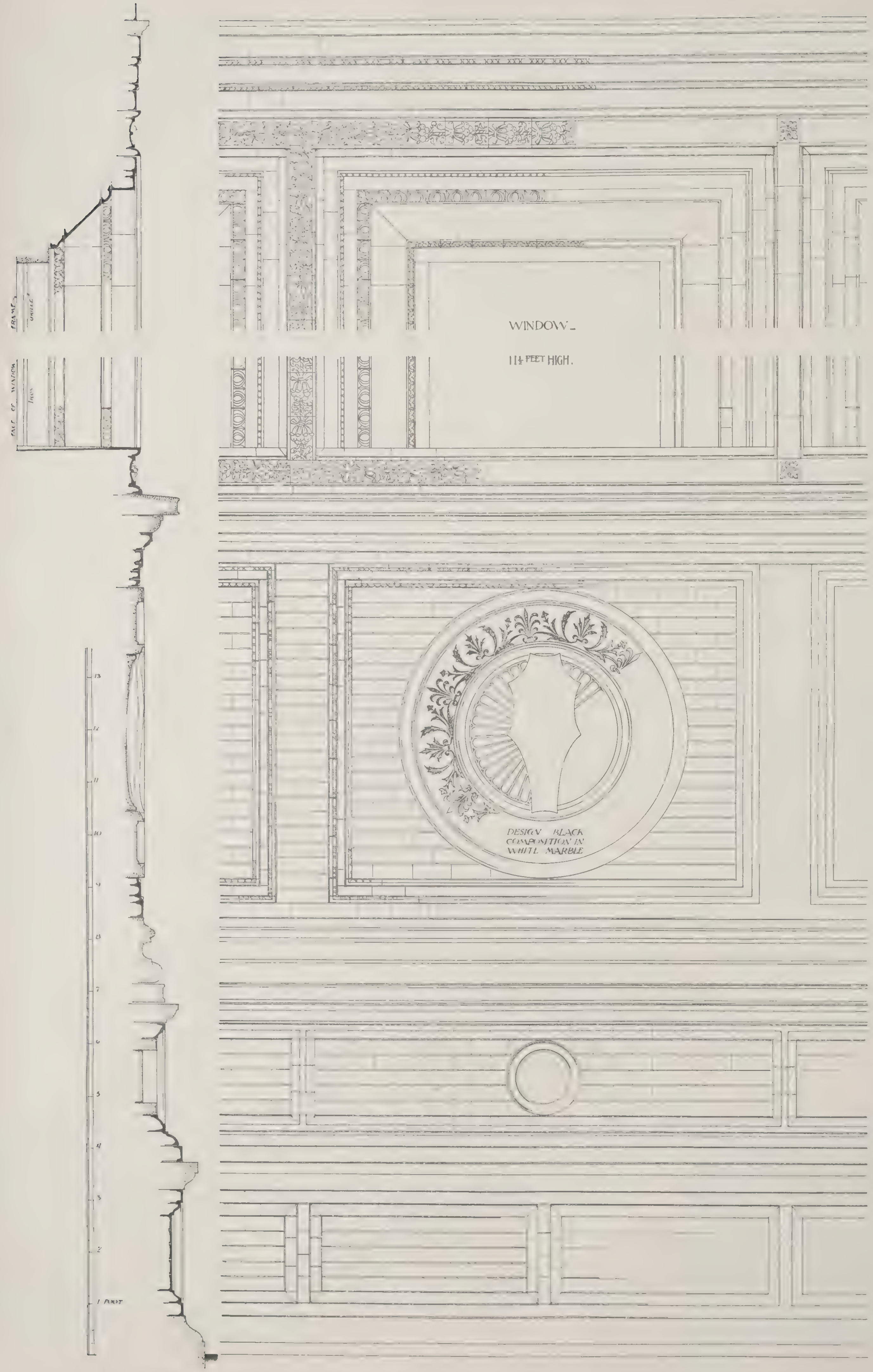
$15.00 and upwards.

Our sketch-book containing 40 designs
will be sent free on application.

⚜

Phila. & Boston Face Brick Co.,
No. 15 Liberty Square, Boston, Mass.





MEASURED DETAIL OF APSE OF S. MARIA DELLE GRAZIE, MILANO.

MEASURED AND DRAWN, 1894, BY JAMES P. JAMIESON, PHILADELPHIA, PA. FIRST TRAVELING SCHOLAR IN ARCHITECTURE, UNIVERSITY OF PENNSYLVANIA.

ARTHUR D. ROGERS.
FRANK C. MANSON.

· THE ·
BRICKBVILDER
An Illustrated Monthly
devoted to
Architecture in Materials of Clay.
ROGERS & MANSON,
PUBLISHERS.

OFFICE: 85 WATER STREET.
P. O. Box 3282.

Boston, March 15, 1897.

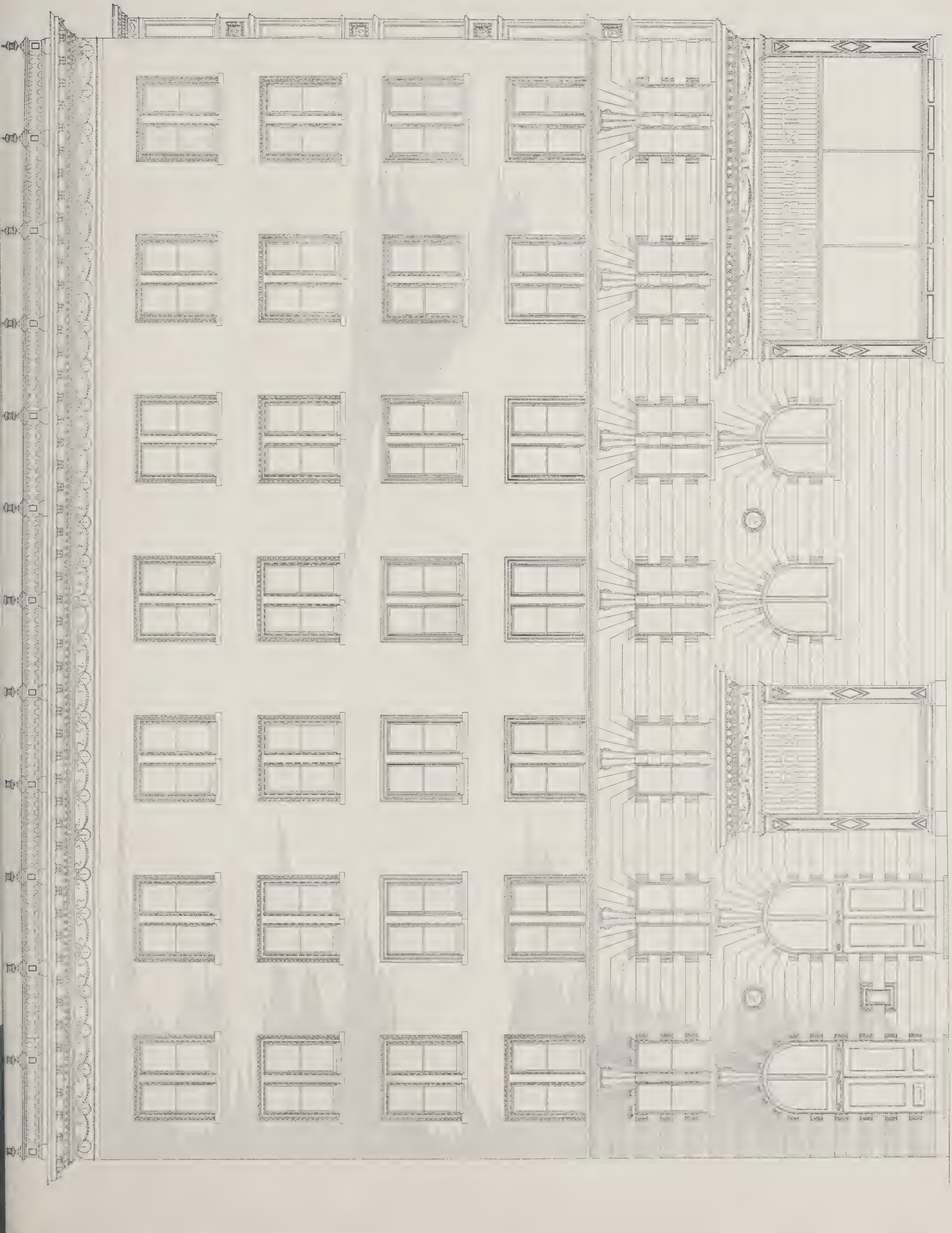
The Public Library of the
City of Boston.
Herbert Putnam Esq.

Dear Sir:

Your favor of the 13th inst at hand. Replying to same, would say that under separate cover we are mailing you to-day plates 31, 36 and 62 of Volume V of THE BRICKBUILDER. We cannot supply you with plate 55; file of same being entirely deplete. Regretting exceedingly our inability to fully comply with your request, we remain,

Very truly yours,
Rogers and Manson.

M. L. P.



FRONT ELEVATION LODER BUILDING, PHILADELPHIA, PA.

CHARLES BALDERSTON, ARCHITECT.

VOLVME V NOV. 1896 No. 11

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.00 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connections, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

AN article by Mr. Cusack, in the last number of THE BRICKBUILDER, emphasizes a lack in the Americans practise of setting terra-cotta to which we have previously called attention in an indirect manner, but which is in some respects so important a factor of successful work that it deserves serious consideration. Well designed terra-cotta is to all intents and purposes a mosaic composed of relatively small pieces of burnt clay. If properly considered, the jointings are a very important feature and influence very strongly the resulting effect, but no matter how carefully they may be devised by the designer, nor how truly the surfaces and angles may be molded and wrought by the manufacturer, if the resulting product is set carelessly or indifferently, without due attention to the desired effect, the terra-cotta will have an unsatisfactory, half-finished appearance. In this country, so far as we know, the setting of terra-cotta is generally entrusted to ordinary brick-masons, and it is rare to find a gang of men on a large building who have had special experience in this material. Mr. Cusack, in his article, alludes to a custom prevalent in England which might be copied in this country with eminent success. The British manufacturer of terra-cotta sets his own work, and either employs directly a trained staff of skilled workmen or sublets the setting to an experienced, responsible contractor who in turn makes the business a specialty, so that the setting of the material is immediately under the control of the manufacturer. This is as it should be, and is such an improvement over our own methods that the adoption of such a course by our builders cannot be too strongly urged. Even assuming that the average mechanic is willing to expend his best work upon the setting of the terra-cotta which comes to the building, an assumption which is by no means warranted by facts, it is nevertheless quite manifest that the best intentions cannot be depended upon to produce the best results in connection with a material which can be so easily disfigured or bungled in place as terra-cotta. The processes of evolution by which our builders and owners have been educated to a due appreciation of the intrinsic excellence of terra-cotta have been so slow that even now the material is seldom used for its full value, and though when properly applied and correctly designed it has been proven repeatedly that it can hold its own with any other material in the market, it is not easy to persuade a fastidious owner that it is a suitable material to be used anywhere within easy reach of the eye. He is likely to contend that those portions of a building which can be touched ought to be of another material, that terra-cotta is of practical no less than artistic value only when seen from a distance, and that its use for the front of a building implies a free, bold treatment which will not bear close inspection; the finished workmanlike appearance which is so easily obtained in some other materials being an altogether doubtful quantity as regards terra-cotta. This feeling, or, to express it more strongly, this lack of appreciation, undoubtedly arises from the indifferent habits of setting the terra-cotta with which we are obliged to content ourselves in this country. It is only one of the many evils which have resulted from the aggregation of small contractors under the head of a master builder, and, as Mr. Cusack very truly intimates, when we have once learned the secret of setting our terra-cotta correctly, we can carry it clear down to the ground and place it where it need not fear the closest scrutiny, where delicacy and sentiment in design can be appreciated quite as much as breadth and rough freedom. Terra-cotta, perhaps least of all building materials, can with impunity be slighted in setting. The joints and the courses simply will not take care of themselves, and the utmost care is required to so place the material that the poor workmanship will not obscure the excellent artistic qualities. A material which comes to the building, as it were, fresh from the hand of the artist surely needs no apology for itself. If we are to continue our stereotyped methods of handling building material, which are admirably adapted to grinding out quantity to an almost unlimited extent, we must expect that in the process the delicacies of terra-cotta are often to suffer, but there is every indication that our architects and manufacturers appreciate the loss which results from such a course, and the day is not distant when the setting of terra-cotta, while no less of a science, will be more of an art, and the material will receive the consideration it deserves.

THE T Square Club, of Philadelphia, is one of the few organizations that are thoroughly alive and are able to make their influence felt for the good of the profession, and it has done a good work in publishing in convenient and available form its Thirteenth Annual Report. One cannot glance over the summary of the work of its various committees without appreciating how much need there is for just such effort as this institution is able to render available and of tangible effect. The club has always put itself on record upon the important questions which have come to the front in Philadelphia within recent years, and whether in regard to its stanch attitude in support of the jury of awards for the Art Museum competition, or in its relation to the draughtsman through its admirably conducted competitions, the club has shown a worthy reason for its existence and has merited the support which the best elements of the profession in Philadelphia have accorded it. The report emphasizes the necessity for a broader civic interest on the part of the architects and for a more personal share by them in their public duties as citizens who are trained to appreciate the architectural needs of a city in which the art element is passing through a very remarkable expansion. Let us hope the club may be able to do for Philadelphia what Haussman did for Paris.

OUR attention has been called to a development of the skeleton construction, which may almost be called the *ratio ad absurdum.* This scheme proposes an ashlar facing for office buildings and commercial structures consisting of a thickness of only two inches of terra-cotta, each block being separately held by a clamp carried back to the steel skeleton, the ashlar work standing out entirely free of the steel, so that a space of two inches or more intervenes. We have heard of buildings in Chicago in which the brick mullions for the windows were constructed with a T-iron faced with a single thickness of brick, each brick being wired to the iron with copper wires. Constructions of this sort are what tend to bring good honest brick and terra-cotta work into disrepute, and they are what have done so much to associate in the minds of conservative investors an idea of inherent shoddiness as a necessary concomitant of the skeleton construction, an association which fortunately is not justified by facts.

PLATE ILLUSTRATIONS.

PLATES 63 and 64 show the front elevation, details of same, and two floor plans of the Burnham Athenæum at Champaign, Ill., J. A. Schweinfurth, Boston, Mass., architect. The building is constructed of Powhatan white brick and terra-cotta to match, from Perth-Amboy Co.

Plates 65 and 66 show the front elevation, perspective, and ground floor plan of the M. E. Church, at Newton, Mass., Cram, Wentworth & Goodhue, architects. The materials used are gray brick and pearl-white terra-cotta. The roofs and domes are covered with copper. The interior shows simply a large auditorium in the form of a Greek cross surmounted by a dome, and with four arms covered with semicircular barrel vaulting. Groups of Corinthian pilasters support the semicircular coffered arches of the dome. The church has no galleries, and affords an unbroken auditorium. It is hoped that ultimately the dome and the large lunette in the chancel may be filled with wall-paintings. The Sunday-school building is so arranged that the seating capacity of the church may be increased by throwing in all the seats in the main schoolroom. The arrangement of the plan was made necessary by the limited dimensions of the lot.

Plates 67 and 68 show the Jackson Street elevation of the Great Northern Hotel, Chicago, D. H. Burnham & Co., architects. The entire front of this building is of white terra-cotta, very elaborately modeled, same being the work of the Northwestern Company.

Plate 69 shows the Colombier d' Ango, Verangeville, France.

This colombier, dating from early in the sixteenth century, is a most charming example of the use of different colors of brick and stone combined in surface patterns. The materials used are red and black brick, gray limestone and flint, the rough faces of which vary in color from light gray and yellow to a deep blue black.

The drum is 25 ft. 10 ins. in diameter, and 19 ft. 11 ins. high, crowned by a roof of small flat tiles, making the entire building about 36 ft. 6 ins. high.

The first story above the base is in two belts, the lower being a diaper pattern of red and black brick with a square set diagonally at the top. This square is very carefully made of four pieces of red and black where it can be seen from the court; but at the rear only two pieces of red are used. Limestone is used in the second belt for the larger squares, black brick stretchers and small red squares.

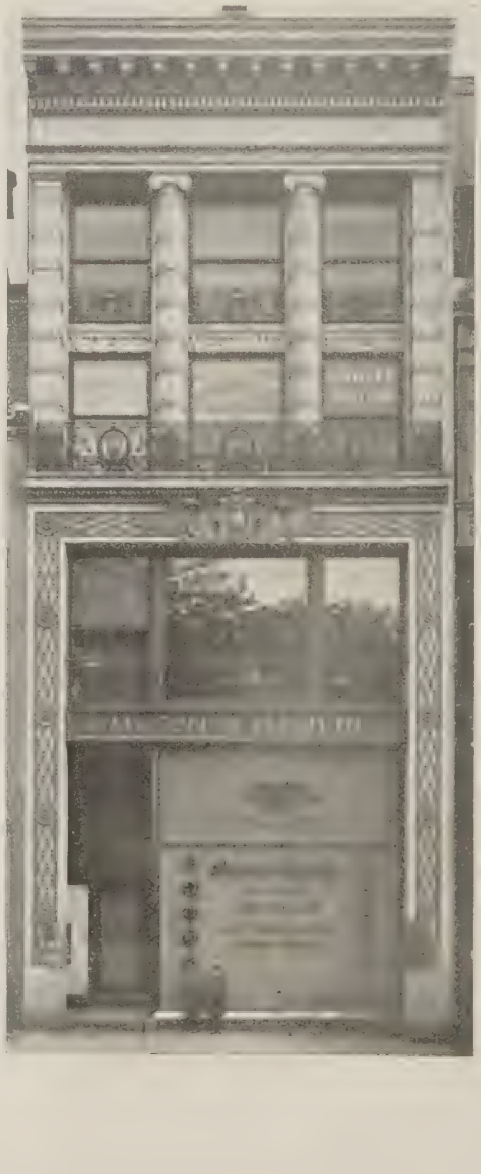
The second story is divided into several belts, the first being a series of small limestone squares separated by red brick; second, a narrow stripe of red brick with a simple figure in black; third, of large limestone squares set diagonally and separated by squares of equal size formed of smaller pieces of flint; fourth, a red brick course pierced with holes for ventilation; fifth, of another series of limestone, flint, red and black brick squares; and lastly, of the red brick cornice, which, on account of its slight projection, really counts more as another ornamental belt than as the cornice to the entire building. The roof is of red and green tiles delightfully mixed together.

The history of the building is also rather interesting as illustrating human nature and accounting for its extreme elaboration. At the time of its erection only the nobles might build dove-cotes without royal permission; therefore when François première gave the right to Ango of Dieppe, the richest man in France, he determined to build one which should surpass those of all the nobles, and although several others have since been erected which exceed it both in size and amount of ornamentation, it was, at the time of its erection, the largest and most ornate in the country.

Plate 70 shows the front elevation of the Quadrangle Club at Chicago. D. H. Burnham & Co., architects. The walls of the building are of red pressed brick with white joints and band courses of red terra-cotta. The broad frieze and cornice are white.

ILLUSTRATED ADVERTISEMENTS.

A GOOD example of how to treat a store, with offices, etc., above, and built on an extremely narrow frontage, may be seen on Boylston Street, Boston, just opposite the Common. A simple architrave forms an appropriate frame to the two first stories. The banded columns and pilasters to the stories above are excellent, and these features have *not* been disgraced by a galvanized iron cornice. The whole of the front is in terra-cotta, of good quality and finish, and the work has been carefully set, which is a matter of equal importance. The architects were Shepley, Rutan & Coolidge, and the work was supplied by the New York Architectural Terra-Cotta Company.

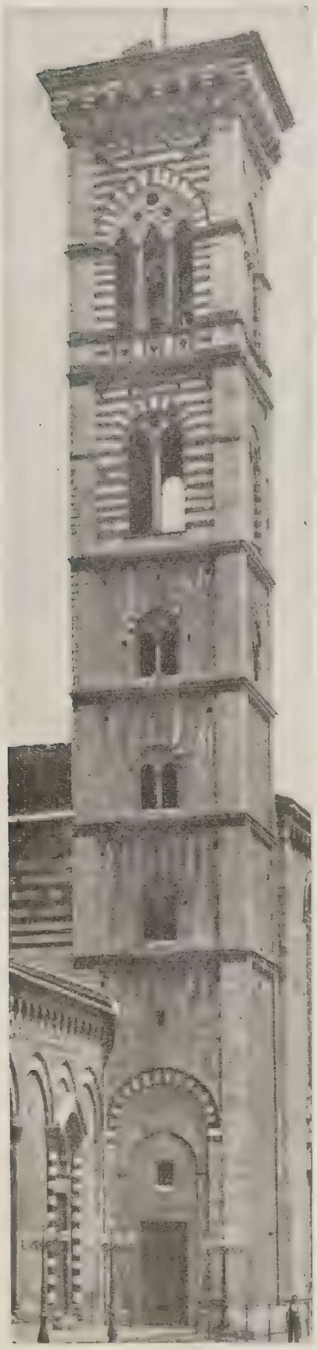


In the advertisement of Charles T. Harris, Lessee, page xxviii, is shown the front and side elevations of the new residence for W. D. Hollis, Esq., at Chicago. These illustrations show to good advantage the effectiveness of a tile-laid roof.

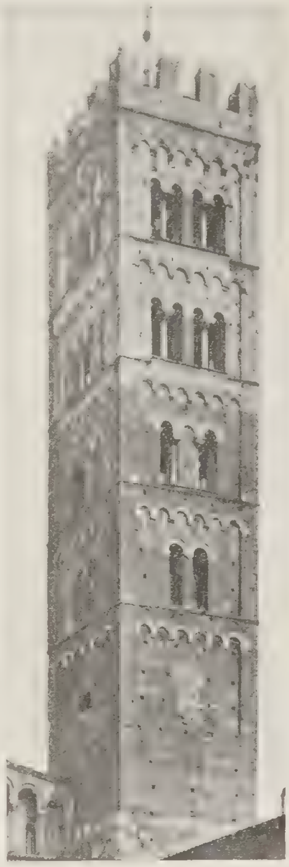
Italian Towers. II.

BY C. HOWARD WALKER.

IN the last paper the campaniles of Rome alone were mentioned, and in most cases they were the square towers of the basilican churches, built in the ninth, tenth, eleventh, and twelfth centuries. It is an interesting study to follow the development and changes of the campanile form through the Lombard period to the Gothic, and later to the Renaissance types. The sequence of variations is natural and readily interpreted. It is more evident in the plans, perhaps, than in the details or the elevations. The earlier towers are of square plan, perpendicular or but slightly battered from base to summit, and with flat or very low pitched roofs. The termination of the towers varies in different localities, partly from tradition, and partly from local conditions. In Rome, where, despite the internecine warfare of the Colonnas and Orsinis, the city was protected by the powerful arm of the church from its walls, and not from its towers, and no symbol of factions appeared upon the campanile; they are devoid of the battlements and machicolations so frequent in Tuscany. The Roman towers have distinct though slightly projecting eaves, and give no suggestion of a fortified watch-tower. Throughout the hill towns of the Apennines, and in the greater northern cities of the plains, both the towers of the Palazzo Pubblico and of the cathedrals were fringed with the forked parapet of the Ghibellines, or the stern, square-cut battlements of the Guelph, and because of the silhouette against the sky of crenellations instead of a roof, these towers form a distinct class by themselves. They may be found in Florence, Siena, Lucca, Pisa, Pistoia, Prato, S. Gimignano, and Volterra. A development of this form is the square tower, which is surmounted by a smaller tower of the same shape. The type is usually civic rather than ecclesiastic, and is seen at its best in the towers of the Palazzo Pubblico in Florence and Siena and in the Castello of Ferrara. The Florentine tower was built about the year 1300, by Arnolfo da Lapo; the Torre della Mangia, at Siena, from 1325 to 1345; and the Ferrara Castle towers in 1385. The variation of an octagonal tower above a square is more frequently adopted for campanile of churches than the preceding type, though it is contemporaneous with it. This form may have been derived from the East. It was used throughout Syria and in Cairo, and along the northern coast of Africa in the ninth and tenth centuries. In Italy it is usually crowned by a spire; although this is not always the case, as is evidenced by the tower of the Frari in Venice. With the introduction into Italy, at the middle of the thirteenth century, of Gothic forms and details, all the earlier forms of towers were further developed by the introduction first of high-pointed roofs or spires, and later by enlarged opening and Gothic detail. The fourteenth century is perhaps more prolific in towers in Italy than is any other period; and the beauty and grace of their long, delicate, perpendicular lines is unexcelled by the richer and more highly decorated towers of the northern cathedrals.

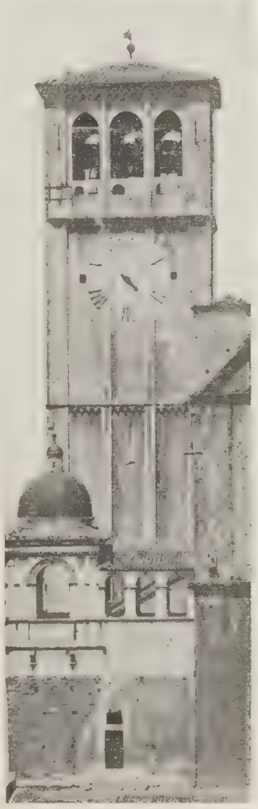


TOWER OF CATHEDRAL AT PRATO.



CATHEDRAL, LUCCA.

The Italian tower is always simple in mass and direct in expression, is seldom richly ornamented, excepting in its moldings, is comparatively lacking in finials, crockets, pinnacles, and the superabundant intricacies of the French Gothic, but in its delicacy of proportion and purity of line it compares favorably with much more ambitious architecture. Of the early type with parapet, the cathedral and S. Frediano at Lucca are excellent examples. Both of these towers were built about the end of the ninth century. They somewhat resemble the Roman campanile, except that they are more massive in proportion. The successive stories plainly announced upon the exterior are nearly equal in height. The string-courses, instead of being carried around the tower, are stopped by the long, perpendicular pilasters formed by the thickening and strengthening of the walls at the corners, and the corbels are replaced by a series of small arches, forming a corbel-course. The openings increase in number upon each story as the tower ascends. The parapets are of the Ghibelline type. [1] S. Pietro Somaldi, in Lucca - a church little known, has an excellent brick tower of the thirteenth century, with low roof without parapet. The belfry story is especially well proportioned.



S. FRANCESCO, ASSISI.

The lower portion of the tower of the church of S. Maria [1] Maggiore, at Barletta, is of the twelfth century and of very dignified proportions; the termination of the tower, while excellent, bears evidences of being of much later date. Perhaps the simplest and, in many ways, the most impressive of these early towers is the northern tower of San Ambrogio, in Milan, built in 1129. It is almost entirely devoid of detail, but is most successfully proportioned in relation to the façade of the church as seen from the atrium. The tower of the cathedral of Prato has strongly pronounced belt-courses, in this respect resembling the Roman towers. Its detail, however, is distinctly Gothic, of fourteenth century character. [1] S. Pietro, in Bologna, has a most unusual campanile, not only in the disposition of the window openings, but also in the peculiar form of the spire. This tower was probably built early in the fourteenth century, but its pinnacles and the peculiar form of its roof may be of later date. It is slender and graceful, yet does not lack an imposing strength. The tower of S. Maria Novella, in Florence, built about 1300, is peculiar in that it has a very steep and high spire-like roof and gables. This roof is badly proportioned, and seems inferior to the rest of the tower. The most delicately proportioned of all the thirteenth century campanile is that of S. Francesco in Pisa,[1]—a church little known and seldom photographed. The tower is slender, with fine lines and exquisitely proportioned detail of a Gothic character, so disposed that the corbel and string-courses seem to sparkle with light and shade. The top story is a somewhat awkward addition of later date, although from its Gothic character it cannot have long antedated the original tower. With the exception of the tower of Vicenza, there is no tower in Italy that gives more the impression of subtlety and delicacy than does that of S. Francesco.

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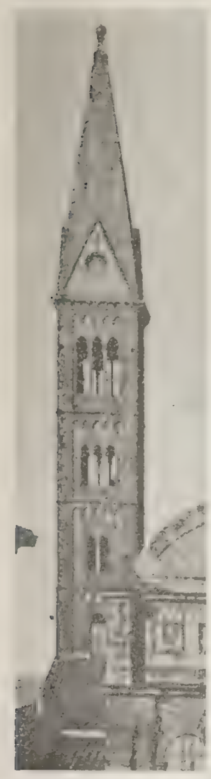
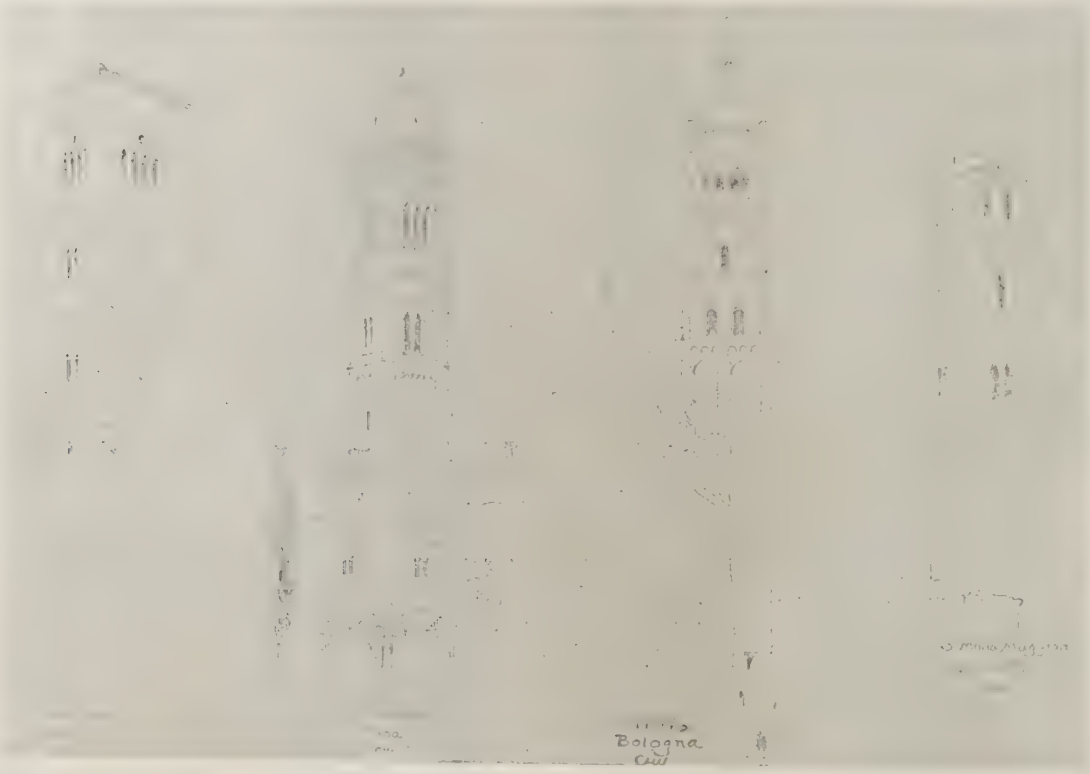
[1] The towers of S. Francesco and of the cathedral in Assisi are good examples of the early type.


S. MARIA NOVELLA, FLORENCE.

In nearly all Italian towers before the period of the Renaissance, the moldings are few, being principally string-courses of double cymas, or a cyma and a cavetto. These string-courses marking each story are usually placed on the sill line of the openings, but occasionally at the actual line of the floor itself. The string-course is enriched by a single or double row of corbels below it, with molded or carved faces, or by an arcaded course or richly detailed brick cornice course. The long buttress-like forms at the corners are of but slight projection and seldom have the line of the inner reveal carried intact full height, as the face of the buttress is usually flush with the face of the corbel course and fuses into it so that the buttress line is broken below each string-course. The eaves project but little more than the string-courses, and the point of the base of the rafter is kept well inside the ashlar face of the tower, thus avoiding the heavy effect of hopper roofs of any angle where the pitch of the roof begins at or outside of the face of the wall. The walls of the towers batter slightly, producing by this means an additional impression both of solidity and height.

CATHEDRAL, ASSISI.

The batter of a wall is best when it is not immediately apparent and when it increases perpendicular prospective without announcing its existence. The batter of the walls is a regular slope, not an entasis. It is probable that a slightly curved batter would be even more effective, tending to lead the eye upward by a more subtle line. The lightening of the upper stories by increasing the size and number of the openings, thereby producing greater delicacy of effect, is common to all the later Italian towers.



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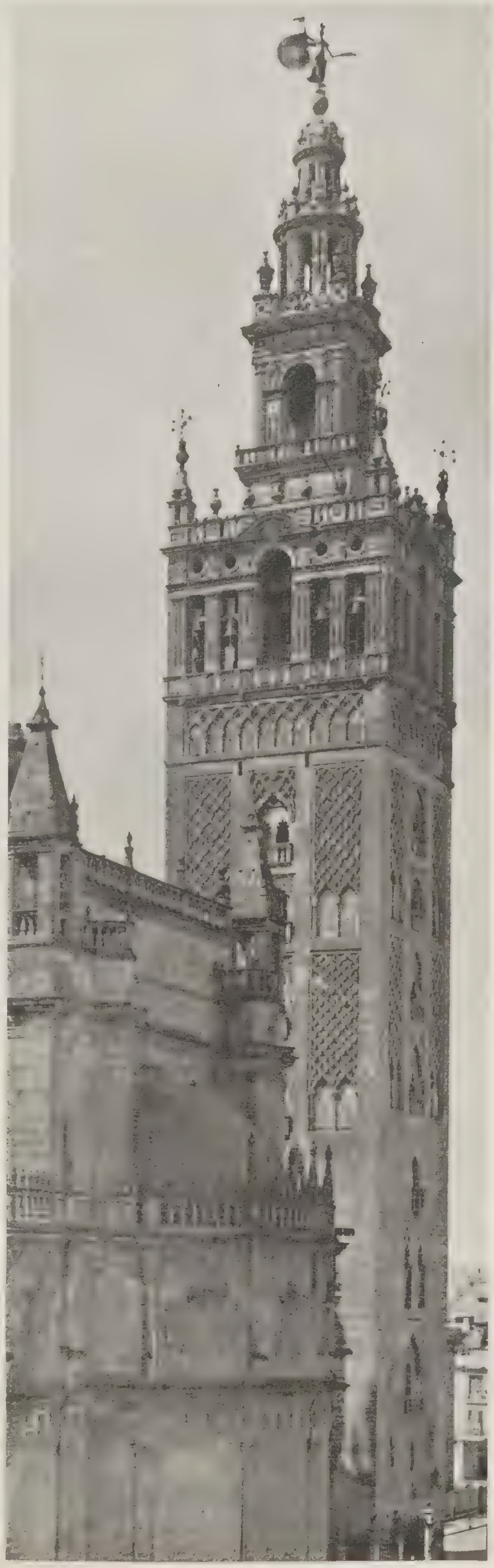
[1] The towers of S. Francesco and of the cathedral in Assisi are good examples of the arly type.

Spanish Brick and Tile Work. III.

BY C. H. BLACKALL.

THE Moors never made any very serious use of stone in connection with their architectural structures, having a marked preference for brick or terra-cotta. Their architecture as developed in Spain was so purely a matter of decoration, and the materials themselves generally counted for so little, that this preference is easily understood. With the tendency to work from a small unit up to large decorative results, and the geometrical as well as the painstaking bias of Moslem art, the small unit afforded by a bit of burnt clay was, from their standpoint, more manageable than huge blocks of masonry; or, to put it another way, the Moorish art was built up, in distinction to the practise in nearly all other countries of, so to speak, cutting down. Consequently, whenever the Moors did undertake to use stone, they fell very easily and almost inevitably into forms and arrangements which are essentially of brick or terra-cotta origin, and it is well worth while, in considering the general subject of Spanish brick and tile work, to include one of the most notable of these stone attempts, namely, the Mosque at Cordova, a structure which of itself has been ranked as one of the marvels of the world, and which never fails to arouse the utmost enthusiasm on the part of every artist whose good fortune leads him to the ancient city of the Moslem Caliphat. Ab-der-Rahman, in 770, after declaring himself independent of the sovereignty of the Caliphs of Damascus, resolved to erect at the center of his Spanish empire a mosque which should be of surpassing grandeur and magnificence. In plan, the building consists of a vast rectangle enclosed by heavy outside walls, with a low, vaulted roof supported by a forest of isolated columns, which are said to have been stolen outright from old Roman and Christian temples, and cut off or pieced out to the required length. They are of rare marbles, porphyry, jasper, and other precious stones, and stretch out indefinitely in every direction, giving the idea of vast expanse and a bewildering maze of architecture. The columns are connected by a double row of arches, the lower simply acting as a brace, and the upper arches directly supporting the vaultings. The arches are in bands of red and white, the red being apparently formed with brick and the white with stone, though in some cases this seems to be all stone and the construction has been painted and stuccoed so often that it is hard to determine the exact material. Apart from the shafts of the columns, the architecture is essentially brick and terra-cotta in its appearance.

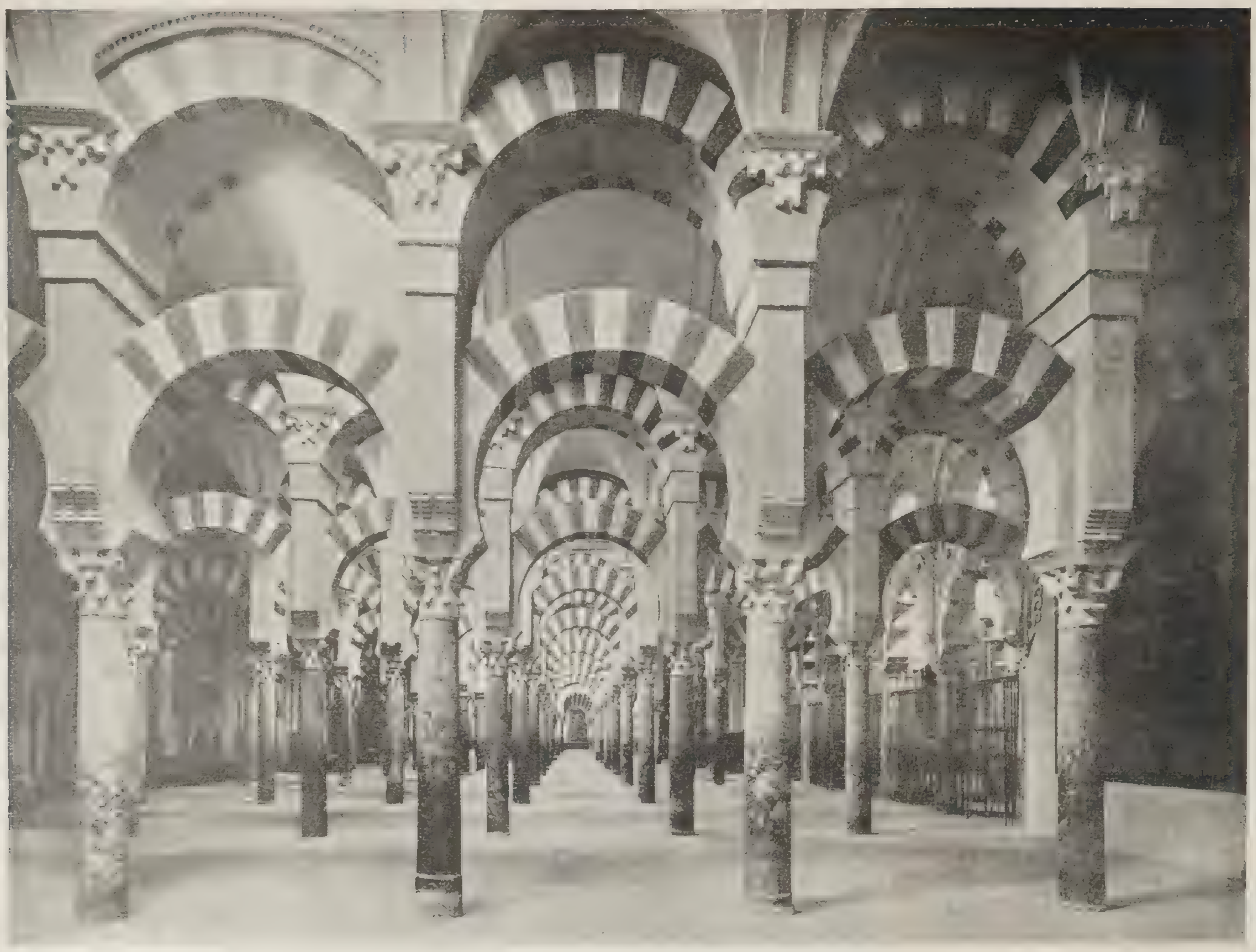


THE GIRALDA, SEVILLE.

Theophile Gautier, who was so keenly alive to the beauties of Spanish architecture, characterizes this mosque as having a richness, a beauty, and a fairy-like elegance of which the equivalent has been found only in the "Thousand and One Nights," and which owes nothing to any other period of art. Never were lines better chosen or colors better combined. It shows the Arab civilization at its highest development, and rises to a dignity of conception and a grandeur in execution never excelled in any of the Arabian work, either Eastern or Western, having all the delicacy, the beauty of fine detail, which characterizes the Alhambra, but with a breadth of treatment and a certain simplicity of general intent such as is seldom found in Moorish work.

The ancient city of Seville is wonderfully rich in architectural remains of all the periods which have found manifestation in Spain. Of brickwork, purely as such, the examples are few, but they are worthy types of their kind. Annexed to the church of San Marcos there is an interesting Moorish brick tower, one of the oldest of its kind and very dignified and graceful in its treatment. In its treatment of wall surfaces and its use of detail it is a considerable advance over the Toledo and Northern examples which have been previously illustrated, and the crowning belfry, although a later Christian addition and of manifest incongruity of style, matches very cleverly with the feeling of the lower portion, and it is quite possible that the original Moorish termination was not unlike what now exists.

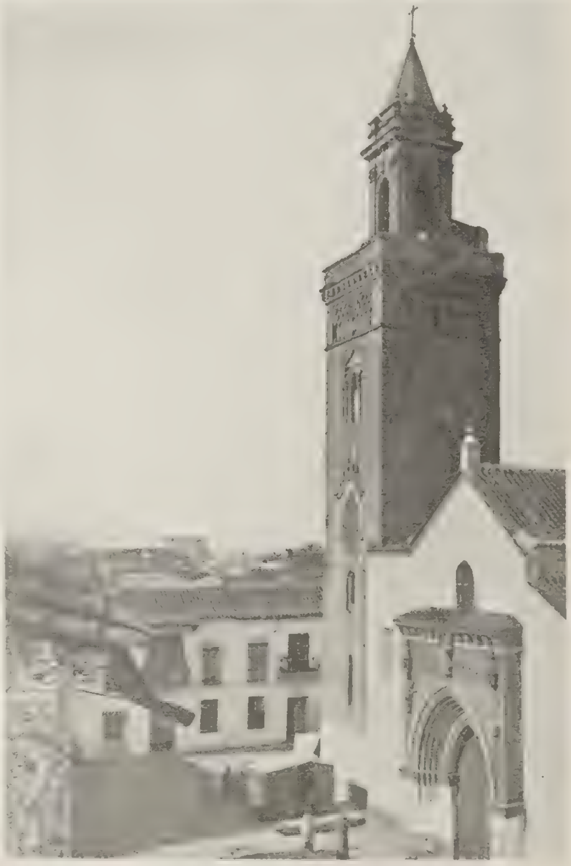
The example of Moorish brickwork which is accepted as perhaps the most perfected of its kind is the tower of the Seville cathedral, known, by reason of the weather-vane on the top, as the Giralda. This, however, like other Moorish towers, is a mixture. The portion up to the bell deck was erected about the year 1000, and was originally used as an observatory, forming a part of an old Moorish mosque, traces of which are visible in the adjoining walls of the cathedral. The upper portion was added by the Christian conquerors in 1668. The crowning figure of bronze, which weighs over three thousand pounds and is pivoted to turn with the wind, is undoubtedly a late Renaissance addition. The Moorish portion of the tower, and a great deal of the upper portion as well, is entirely of brick, and so well constructed and of such excellent material that the angles and jointings seem to be as sharp as though laid within the present generation. The



INTERIOR OF MOSQUE OF CORDOVA.

treatment of the wall surface is similar to what has been noted elsewhere in Spain, and, combined with the delicately designed openings, gives an exceedingly harmonious and pleasing result. The design as a whole could doubtless be greatly improved. The inconsistencies of style are quite manifest, and the details of the Renaissance portion are by no means on a par with the delicate Moorish tracery; but there is hardly a tower anywhere in the world which is quite so satisfactory as this splendid shaft. It rises to an altitude of something over three hundred feet, and the horizontal dimensions imperceptibly diminish in height so that the towering appearance is greatly enhanced. Inside there is a ramp with easy slope, paved with bricks, which is carried up in a spiral of a width sufficient to permit two horsemen to ride abreast. The existence of this ramp is slightly accused on the exterior by the difference in level of the openings.

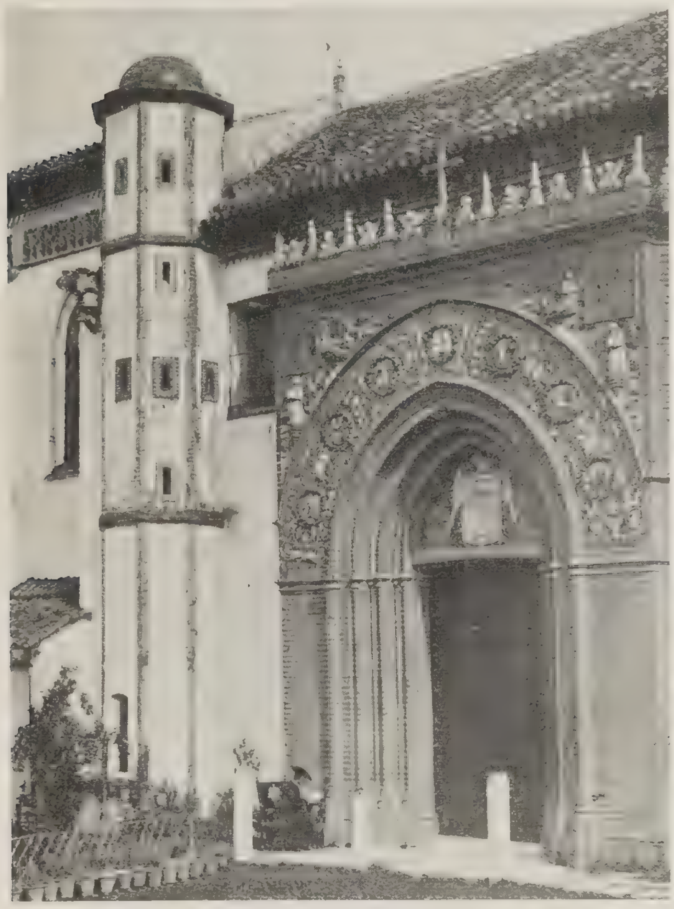
A study of almost any type of Spanish architecture is apt to prove disappointing on account of the lack of precise information and of exact documents. The Convent of Santa Paula, at Seville, is an instance in point. Very little information can be gleaned in regard to it except the fact that it was founded in 1745. It is in some respects the most distinctively Spanish piece of work which could be cited as illustrating the tendencies of the composite art which succeeded the Moors. The tympanum over the doorway has a ground of glazed tiles in the strong, deep colors which are so characteristic of Southern Spain, with a coat of arms in low relief occupying the center. The broad band outside of the arch moldings is also of glazed terra-cotta, the medalions representing scenes from the life of the saint, and the groundwork surrounding them being decorated in the most elaborate late Italian style. The medallions merit a closer investigation than the accompanying photograph will permit. They are in a low relief, and are beautifully modeled in a manner which recalls very strongly the Della Robbia work on the Pistoja Hospital. This Spanish example lacks the naive, direct expression of the Italian work, but the modeling is quite as good, and there is a sense of delicacy and refinement about the little figures which arouses a wonder that they should be put side by side with such elaborate



SAN MARCOS, SEVILLE.

Rococo ornament. It is the kind of work which will bear the closest inspection in detail, while at the same time the effect of the general color is extremely striking, with the red and white banded work below and in the arch, and the dull, strong glazes of the tiles. The spandrels of the arch are likewise filled in with a groundwork of enameled tile, the figures and the monograms of Ferdinand and Isabella being modeled in high relief. There is also a band of encaustic tiles forming a part of the parapet above the cornice. The tourelle at the left of the doorway is built of brick, the material showing at the angles and around the openings, while the wall surfaces are stuccoed white. The treatment of the small windows is very pleasing. They are enclosed by a broad band of encaustic tiles in strong colors, and give a delicious little bit of color by contrast with the red brick and the white wall surface.

The type of work which is represented by this portal of Santa Paula corresponds very closely with the style which was exported to Mexico and Florida and reproduced in many of the Spanish-American cities. The combination of the red brick and whitened wall surfaces, or of brick in two colors with splashes of vivid faience, will seem familiar to all who have visited the southern parts of this country and Mexico. It is a charming manifestation of terra-cotta possibilities, which with more care in detail and a fuller consideration for mass, can lead to most excellent results.



SANTA PAULA, SEVILLE.

(*To be continued.*)

CLUB NEWS.

THE Chicago Architectural Club will hold its next annual exhibition in the Art Institute, March 2, 1897.

The St. Louis Architectural Club will hold an exhibition of the club work at some time during the coming spring. The question of taking up architectural history in connection with the club class in architecture, by having lectures once or twice a month, illustrated with stereopticon views was considered, and a committee appointed to take charge of the work.

The Art of Building among the Romans.

Translated from the French of AUGUSTE CHOISY by Arthur J Dillon.

CHAPTER III.

CONSTRUCTION IN WOOD.

GENERAL REMARKS ON THE METHODS IN USE AMONG THE ROMANS.

(*Continued.*)

UP to this point we have studied the ancient roofs only in the original monuments and in texts.[1] It will, perhaps, be more to the purpose to inquire if the tradition of the Middle Ages cannot also reveal to us some facts. The modern roofs of Italy differ but little from those that were raised at the beginning of the Middle Ages; all are more or less like those of the Christian basilicas, and these, built when architecture had no other principles than the more or less accurate memories of the Roman art, are evidently only copies whose models have not lasted until the present time. Such is the chain of tradition that binds to antiquity the ordinary types of modern Italian framing. To retrace this line and show the analogies would be to repeat what has already been said in most excellent works.[2] I will cite only one example, that of the roof of the ancient basilica of the Vatican, whose details I reproduce in trying to interpret a very crude drawing by Carlo Fontana (Fig. 90).

The most remarkable thing to be observed in this drawing is the grouping of the trusses by twos, with an intermediary post, and the seemingly intentional avoidance of oblique pieces. There are no struts, no cross-braces; a simple tie binding the principals near their centers prevents bending, and their wide bearing makes side bracing to keep them vertical unnecessary. And when one examines the details, it is seen that the assemblage nowhere weakens the pieces; an iron pin fastens the upper tie to the principals. The king post cuts neither into the tie which it carries nor the collar beam it meets; it even seems that the contractor preferred the use of stirrups and ties of metal to complex assemblages, where the wood would not be open to the air and might dry-rot. In uniting them by juxtaposition he avoided this danger as much as possible, and the simplicity itself of the construction is the principal guarantee of its durability.

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[1] In order to complete the review of the principal texts relative to ancient framing, I should call attention, first, to the notice which Vitruvius gives it in the fourth book of his treatise (Cap. II.); but this notice, whose object is to show the analogies between the structure of edifices in wood and that of the ordinance of Doric temples, is so vague that we can learn from it, strictly speaking, no details special to ancient framing. I could not pass over it in silence, but I think it would be superfluous to translate it. Second, an inscription commented on in turn by Ottfr. Muller and M. Rangabe ("*Ant. Hell.*," 771) gives the arrangement of a roof with one slope that covered the long walls of the Pirea. This shelter, however, was of an elementary simplicity, and the interest of the inscription is only that it adds some words to the vocabulary of the art of framing among the Greeks. Third, a more significant text that treats of a roof of the basilica of Fano. (See "*Vitr.*," Lib. V., Cap. I.).

M. Viollet-le-Duc drew from this passage the elements of a restoration, that, as a whole, gives the essential traits of a Roman truss. Two roofs in the basilica of Fano crossed at right angles, and Vitruvius took pains to insist on the equalizing of the two trusses. It is seen from his description that the ancients simplified the intersections of their roofs with the same care that they took to avoid penetrations in their vaults. No diagonal trusses or hip trusses; one of the roofs was continuous, and the other framed directly into it. See, for the details of this ingenious combination, "*Les Entretiens Sur l'Architecture*" (5th *entretien*). Fourth. Finally, two restorations of ancient roofs made from ruins; that of the odeon of Regillæ, by M. Tuckermann (*das odeum des Herodes Atticus in Athen*), and that of the temple of Pæstum, by M. Aures (*Etude sur les dimensions du grand temple de Pæstum*): this last work shows, by a curious example, how much value an exact knowledge of the harmonic laws that decided their dimensions is in the restoration of monuments.

[2] See in particular Rondelet's "*L'Art de Batir*," Lib. V., 1st section, and "*Le Traite d' Architecture*," by M. Leonce Reynaud, part 1, Lib. III., Cap. I.

The framing of the ancient basilica of St. Peter is known to us through the work entitled "*Il Tempio Vaticano*" (p. 99), and by a view preserved in the church of St. Martin of the Mountains in Rome. The age of this framing must not, however, be exaggerated. I cite it only as a type, not as an authentic example. The entire roof of St. Peter's was rebuilt under Benoit XII., at the beginning of the fourteenth century, and there is no reason for believing that this construction is of any earlier date. I could have taken with equal reason an example from the basilica of St. Paul, which lasted almost to our days, or from the ancient interior of St. John Lateran, which is known by the paintings in St. Martin of the Mountains, or even from the roof of Sta. Maria Maggiore, which dates from the fifteenth century; any of these examples would have justified the same observations and the same conclusions.

An important question about the truss we are examining is whether it was to remain in sight or to be concealed by a ceiling. The answer seems uncertain. Saint Paul, outside the walls, a building of the same date as the basilica of the Vatican, had — as we know from Eusèbe — a horizontal caissoned ceiling. Other monuments, more ancient than the basilica of Fano, had convex, or, at least, broken ceilings, that left the ties and lower members of the trusses uncovered. Perhaps one or the other of these forms was originally used in the Vatican, but at the end of the Middle Ages there remained not the slightest vestige of a ceiling of any kind; and I do not know that a ceiling would have added to the beauty of the edifice. The objection to visible trusses is the complication of their lines, and this complication comes principally from the oblique pieces which, crossing each other in all directions, give to the framing an incorrect and uncouth aspect. Here there is nothing of the kind. Reduced to the elements of which it is composed, the truss has in its general forms an extreme simplicity and perfect regularity. The horizontal direction of the ties and collar beams is clearly and frankly visible, without confusion and without disorder; and it can be said, in summing up the impression produced by this truss, evidently inspired by ancient models or ancient traditions, that it worthily partakes of the severity of style that Roman architecture had the fortunate privilege of preserving up to the last moments of its decadence.

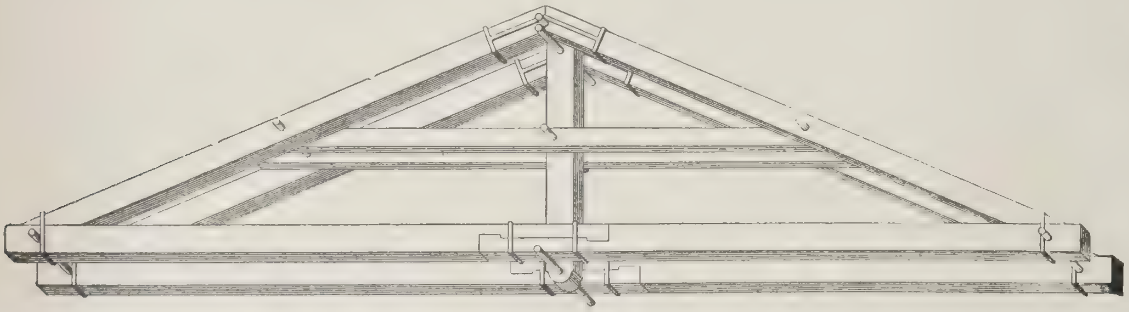

FIG. 90.

Wooden roofs, such as we conceive them from the imitations of the Middle Ages, were characteristic of two periods of Roman architecture, of its rise and that of its decadence. To the intermediary period, above all, belongs the vaulted construction. But by a singular circumstance, and one that shows the power of tradition in Rome, it was with difficulty that the vaults replaced the wooden coverings when the form of the building had been fixed by ancients' usages; and it was to edifices erected for new purposes that they were first applied, as, for instance, to the public baths, institutions unknown to the ancient Roman republic, and whose introduction dates from the time of Agrippa. The temples, on the other hand, did not cease to be built according to the ancient mode; sometimes the ceiling of the cella [1] was replaced by a vault, but on the exterior the porticoes of columns covered with wooden roofs were never changed. The basilicas, though the ancients attributed to them no sacred character, always preserved their primitive aspect and were always covered with wooden roofs; the tradition in this respect was so constant that we can look on the basilica of Maxentius as an isolated exception in a series of basilicas that commences one hundred and eighty years before our era and extends to the end of the empire in the monuments of Christian architecture.

Nevertheless, while preserving the consecrated type of their ancient roofs of wood, the Romans sought at an early date to replace the wood with a less perishable material; sometimes, and principally where wood was scarce, they substituted arches of brick for the trusses; [2] elsewhere they used bronze, an easily worked metal, whose assemblage is still more easy. Sometimes they made only the principal members of the trusses of bronze, but in other cases they excluded wood entirely, making the trusses, and even the roofing, of metal. Before them the Greeks had made some efforts in this direction; Pausanias [3] gives the description of a circular edifice where the rafters of the roof converged, like the spokes of a wheel, toward a central piece of bronze. There is even to be found in his "Journey in Greece" the mention of an edifice cast in bronze, whose name recalls the material of which it was made, — the temple of Minerva Chalciœcos. But these applications were of little importance; it was by the Romans that the idea was generalized and extended. There one sees the roof of the Ulpiennian basilica, entirely of bronze; and the roof of the great hall of the Baths of Caracalla of the same metal. As soon as the first century before our era, bronze was used by the Romans, to the exclusion of all other material, for the trusses of the portico that precedes the rotunda of Agrippa.

This celebrated piece of framing lasted until the middle of the seventeenth century, and the architects of the Renaissance were able to examine and describe it. They have left us some drawings of it, but through irreparable negligence they made them so vague and so incomplete that it is hardly possible to distinguish anything more than the general form of the structure, and its general arrangement. Figure 91 shows what Palladio described; it is a reproduction of his drawing, corrected after attentive study of the traces left by the framing on the monument itself. These indications are of various kinds; the corbels that aided in supporting the roof of the central nave have their lower angles chambered off to make room for the braces, and thus fix the inclination of these pieces; the holes that received the ends of the purlins fix the number of these,

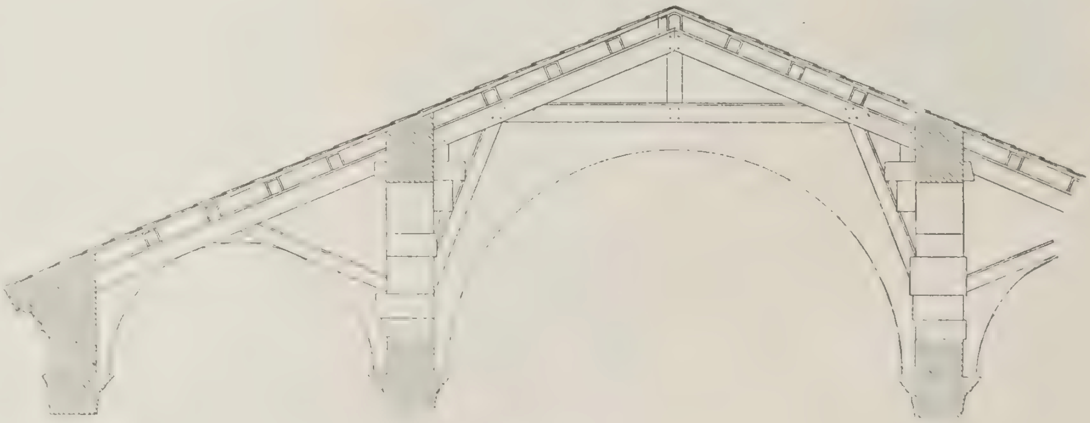

FIG. 91.

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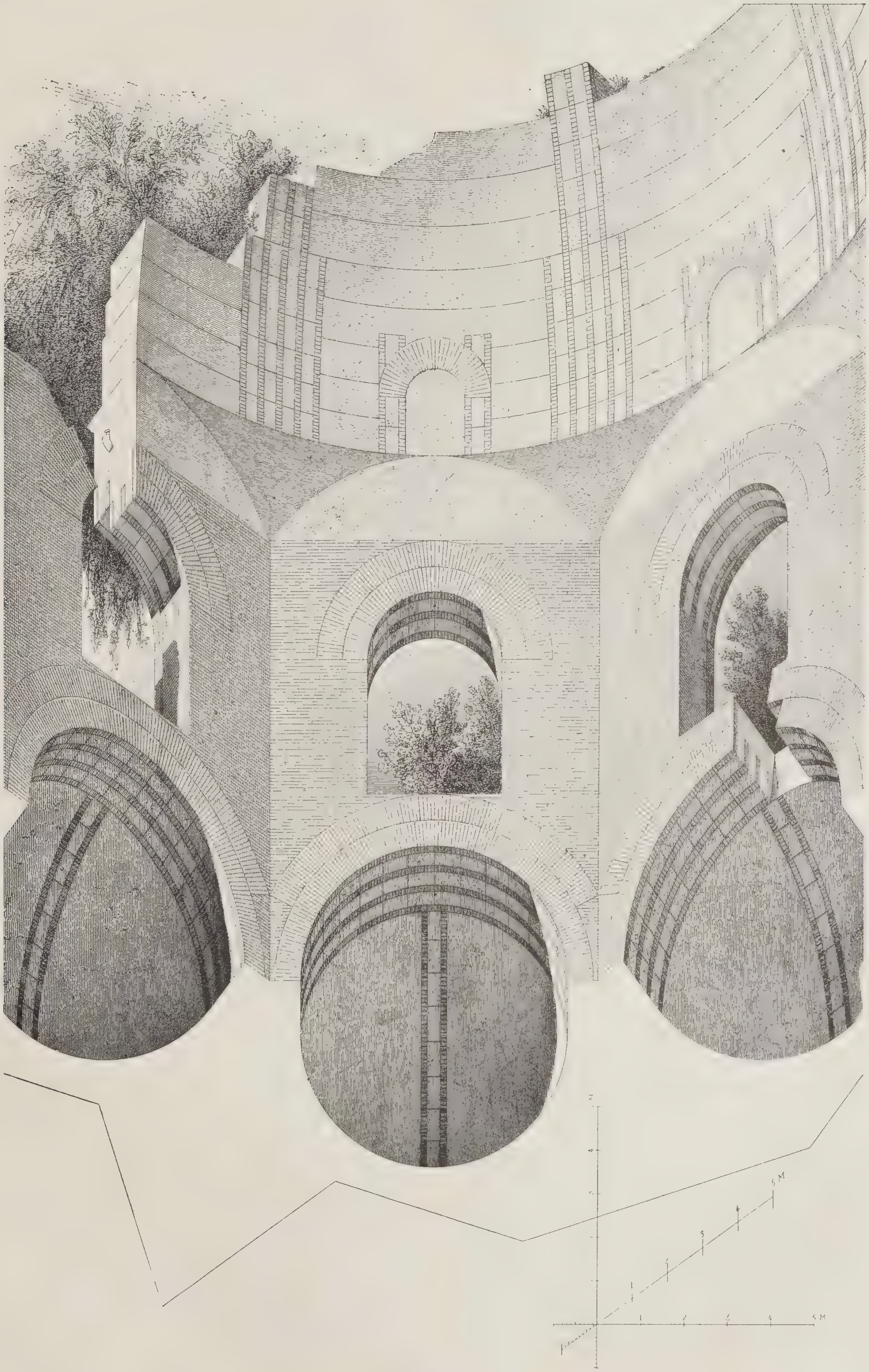
[1] See, on this subject, a curious passage in the commentary of Servius on the "Eneid" (I., 509.)

[2] See Philon of Byzance ("*Vet. Mathem.*," p. 87), and also the graphic interpretation of the text given by M. de Rochas in his translation of Philon.

[3] The Philippeum of Olympia is described by Pausanias ("*Elid.*," Cap. XX.). See for the temple of Minerva, Chalciœcos, Pausanias, *Lacon.*, Cap. XVII.; in relation to the Ulpiennian basilica, Pausanias, "*Elid.*," Cap. XII.; "*Phoc.*," Cap. V., and for the "*Cella Solaria*" of the Baths of Caracalla, Spartian, Cap. IX.



MINERVA MEDICA.
PLATE XI. THE ART OF BUILDING AMONG THE ROMANS.

and the rear wall of the portico gives the exact curve of the bronze vaults that were used for decoration, and consequently shows the height of the lateral trusses; from this their construction can be deduced.

It is useless to seek for the details in Palladio. He drew only a section at a small scale to explain the assemblage, a sketch that can only be understood by the aid of other data which are in themselves quite incomplete, such as a sketch by Serlio and a few scattered notes in writings of the seventeenth century. "Each beam," says one of these allusions, "was composed of three thick sheets of bronze assembled with nails of the same metal,"[1] and in accordance with this description, Serlio shows the portico of the Pantheon with the purlins in the form of a trough. There is, I think, but one way of reconciling this drawing with the description above quoted; it must be admitted that the three plates of bronze of which each beam was composed formed the three sides of a trough. The drawing by Serlio and a text by Donati shows that the troughs were upside down, so that it was only the plates forming the sides that were active parts of the beam, the plate that formed the bottom serving principally to prevent lateral deflection. The architect, however, seems to have been guided less by principles applicable to the use of metal than by his memory of wooden construction. The trusses of the Pantheon were not different from ordinary trusses made with built-up beams, and were made in the manner that would be naturally the first to come to mind; but we may ask if it would be the best way to-day. It is open to doubt. Modern industry, in supplying us with iron beams of forms that can be said to be infinite in variety, allows us to distribute our material far more advantageously, and it would, perhaps, be foolish to imitate this example of a too primitive art. But it is sufficient only to pause over these methods of construction that an isolated edifice gives us scarcely a glimpse of. There are still to be examined two types of works of an entirely different character, bridges and the towers of attack, which the ancients built about besieged towns.

On the subject of military framing, the architect Apollodorus gives a series of principles of which some were certainly applicable to all the rapid construction of the ancients. "These works," he says, "should be made of wood easily found in the forests, varied in their forms, very restricted in size, light, capable of being constructed by the first workmen chance may bring to hand, and quickly erected, simple to repair, protected from surprises, easily transported, slightly combustible, difficult to demolish, easy to take to pieces."[2]

Such were the conditions to be met. An example will emphasize what was common to all, and we will take it also from the treatise on the attack of fortified places, by Apollodorus (Fig. 92).[3]

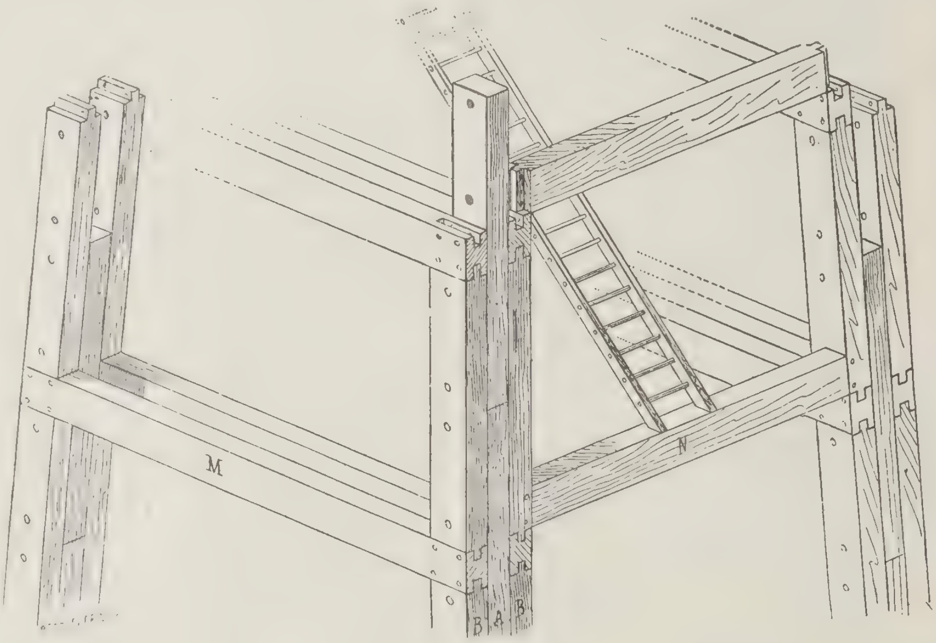


FIG. 92.

Here is, according to the description he gives, the probable aspect of such a tower. The admissible method of construction, as well as the advantages of it, is clearly shown in the figure. What was wished was to avoid the use of pieces of large size, which were extremely rare in certain countries, and which are always difficult to handle; to employ, as the author of the original description says, only pieces of small scantling was the object that was put before all others; and the ingenious system of splicing which he applied to the corner posts accorded most happily with this essential condition.

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[1] "I travi pur di bronzo maestrevolmente fatti chaischeduno con tre grosse tavole da chiodi pur di bronzo connesse, si son veduti a nostro tempo, finche Urbano VIII., l'anno 1627, le levò per farne all' altar maggiore della Chiesa di S. Pietro colonne, ed à Castel S. Angelo artiglerie, ponendovi in loro luogo travi di legno" (*Nardini*, "*Roma Antica*" VI., 1.)

Here is also another text of the same epoch, which confirms and emphasizes the above general explanation: "In ejus porticu æreæ tabulæ fuerant crassitudine quadrantis, ita commissæ, ut in fastigium ab epistyliis elatæ, unam vero superne expansam duæ in extrema ora utrinque suppositæ, alterique transversim conjunctæ fixæque trabalibus clavis, tigillorum tectique oneri recipiendo firmarent." (*Alexander Donatus*: "*De urbe Roma*," Lib. III.; *in the* "*Thesaurus ant. rom. of Grævius*," Tom. LII., p. 755.)

A clue given by Scammozzi is not less unmistakable: "Travi composte de tre tavole di buona larghezza e grossezza di bronzo; cioè due che fanno i lati, ed una di sopra confitte insieme con pironi di metallo" ("*Architt. Univ.*," part 2, l. 8, Cap. XIX.).

One can also consult, on this question of the bronze framing of the Pantheon, Ficorcni, "*Le Vestigia di Roma Antica*," p. 132. These are the principal existing accounts; the Piranesi, whose works give so many important details of the construction of the Pantheon, were not able to make any examination of its framing.

[2] "*Poliorcétique des Grecs*," edit. Wescher, p. 139, l. 5.

[3] "*Poliorc.*," p. 164 and seq. The ties M are the διπλᾶ ζυγά of the text and the interties N the ἐπιζυγίδες. The piece A forming the center of the post at the corner is called μεσοστάτης, and the two adjacent pieces παραστάται. The text can be translated thus: —

"How an attacking tower should be constructed.

"If we have to construct towers near walls, we should make them on rollers, at such a distance from the walls that they cannot be reached by projectiles, and of small pieces of wood, as follows: —

"Two squared pieces, of unequal faces, are assembled with the wide faces toward each other, the narrow face turned down (see M, Fig. 92): two pairs; length, 16 p., depth, 1¼ p., thickness, 12 d. If, however, it is necessary to make a tower of more than 40 p., the length, depth, and thickness must be increased.

"These two pairs are laid on the ground with a distance between each pair of about 12 d., and separated at the top by about 1 p. to receive the pieces A, which reach to the ground; their length is 16 p., depth, 1¼ p., thickness, 12 d. These pieces, fixed by keys, mortises, and cleats, remain vertical.

"To these vertical pieces, which form the center of the corner posts and which are four in number, other pieces of the same thickness and the same width, and 9 p. long, are fastened (B); in all, eight pieces. These pieces, which rest on the lower ties, are fastened to them by irons as well as to A, so that the three pieces together form a single corner post.

"These new pieces are crowned by ties like and parallel to the ties M (here the text, it would seem, should be punctuated in this manner), ἐπιτίθεται ζυγὰ παράλληγα τοῖς κάτω δύο κ. δύο ἐπιτίθενται ὁμοίως, κ. τ. λ. and, just as below, the ties are surmounted by interties N.

"Then, against the corner posts from one course of ties to the next, other pieces are placed, enclosing the square and surrounding the lower platform, fixed by means of keys and mortises; thus the four sides form one solid body. The interties N should be of the same length as the ties M, so that the four corner posts will be equally spaced in all directions.

"In the space left between the lower ties M, wheels higher than the pieces M are placed, projecting beyond the lower face, so as to raise them from the ground and allow the whole system to be moved and rolled along.

"In the same way, to the upper pieces that form the corner posts (in place of ζυγοῖς, read ξύλοις) ties and interties are fastened, like those below, in order to tie together the upper part of the first story of the tower.

"Moreover, the upper ties and interties should be 1 p. shorter than the lower ones, so that the construction, battering instead of overhanging, will not oscillate if overloaded, but will have a firm base on the ground.

"Nevertheless, guys should be attached to the tops of the corner posts, and stretched out in all directions, so as to give, as it were, a second larger base. These guys should be fastened either to stakes furnished with pins, or to pegs of iron with rings, driven into the ground obliquely, so as to resist the pull.

"This being done, the central piece A of the corner posts will be found to extend above the pieces fastened to it by a third of its length. In its turn this central piece will have other pieces fastened to it, which will extend above it, and whose height will be 9 p. On the central piece a similar piece, supported by the side pieces, will be placed; then there will be placed the ties and interties; and so on until the construction is completed. The central pieces A are not taken the same length as the others, so that the joints will not coincide but will alternate, and the corner post get its strength from the pieces fastened together. Finally, ladders resting against the interties traverse the tower from side to side; and thus, using small pieces in small numbers, fastened together, a tower can be built as high even as the fortifications of the place."

This construction is not cross-braced; and it is to be remarked that almost no description advises cross-bracing for engines of attack. Perhaps this was suppressed in order to give a certain elasticity to these constructions, which were subject to the shocks of heavy projectiles; but I rather think that the rarity of oblique pieces is a characteristic common to all the wooden constructions of the ancients; we have seen above that hardly any use of such pieces was made in Italy at the time when the art of framing was directly connected with the Roman traditions; and it would be difficult to find examples either in the paintings of Pompeii or in the miniatures which decorate the celebrated manuscripts of Terence and of Virgil of the Vatican. Here, however, the assemblages are perfectly rigid. In order to make the drawing clearer, I showed the joints ironed together, as would be done to-day; the real assemblage such as given in the text of Apollodorus, and in a commentary byzantin[1] were as shown in Fig. 93.

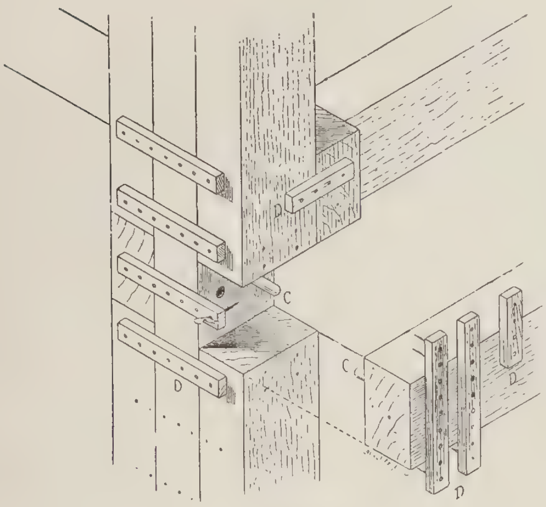

FIG. 93.

In this system, keys, or rather dowels of wood, cylindrical in form, fasten the side pieces to the center ones. They prevent the pieces from slipping on each other, but not from separating; and to prevent this, the pieces are fastened together by cleats of wood such as D, on their faces. The dowels were but big pegs; the dowel holes, auger holes; the cleats, slats or thick laths, simple strips of wood; it does not seem possible to imagine a combination more rapid or more practical. Tradition has partially preserved this method of assemblage; and to-day the verticals of the scaffolds in Rome are made up of small pieces, fastened together by nailed strips; Fig. 94, drawn from one of these modern applications of the system, will aid in the conception of the construction of the built-up pieces of the military constructions of the ancients.

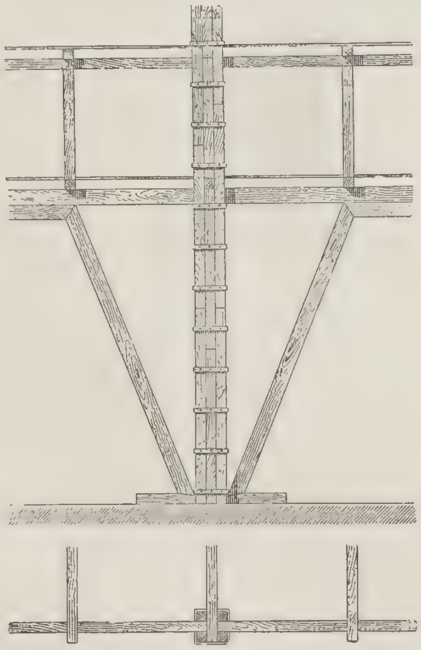

FIG. 94.

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[1] Héron de Byzance, "*Poliorc.*," p. 226, l. 18 and following; p. 240, l. 5.

The tenon dowel C, which the Byzantin author likens to the extremity of the hinge style of a door, is the περιτομίς of the text.

The rounded mortise or dowel hole which receives this tenon or dowel is called χελῶνιὸν; this mortise or dowel hole — evidently made with an auger — is terminated by a hemispherical concavity which causes it to be compared to a hollow hemisphere.

And finally the cleats, such as D, preventing the spreading of the pieces, is given in the text the name κανών.

Fire-proofing Department.

SOME EXPERIENCES OF MODERN FIRE-PROOFING MATERIAL IN ACTUAL TESTS.

BY PETER B. WIGHT.

IT is an old saying that "the proof of the pudding is in the eating thereof," and not at all inapplicable to the "all-devouring" element fire. We hear of all sorts of experimental tests of fire-resisting building materials, but somehow when the building in which they are used takes fire, the results are not always the same. Sometimes those in which some of us had put great faith succumb to slight conflagrations, while others show better results than when we experimented with them. Some serve their purpose well, and others tumble down and leave the building unprotected where this was least expected. It all goes to show that the fire-proofing art does not always consist in having a good material, but rather in knowing how to use it when you have it. As stated in a previous article, a fire-proof material may be used either as a part of the construction where it stands by itself, as in a wall or partition; as combining with other materials to produce a complete constructive feature, such as we see in floors and roofs; or, as a protecting material attached to others that are more vulnerable to fire. Unless skillfully adapted to its use in each case it may fail. The wall or partition may be weakened by fire if the material is not of the proper shape and size, the floors may fall if heat destroys the stability of the filling or has access to the steel beams, and columns or girders may fail if heat dislodges the protecting material. It is not enough to build a wall of good fire-proof material, which is all right as long as it is cool, or a floor arch of the same, which is simply strong, or to cover columns, girders, or other exposed structural members for every-day use. Fire may destroy these conditions unless the work is equally serviceable, whether cold or hot. The several occasions on which buildings supposed to have been fire-proof have been destroyed or greatly damaged will generally be found to be illustrations of the inefficiency with which fire-proof materials have been used in their construction. But while such events are always extensively exploited, there are vastly more occasions where the fire-proof qualities of buildings have saved them from destruction and have elicited little or no notice. These occurrences seldom get into the newspapers, and if they do, are dismissed as events of little importance. The wiseacres never feel called upon to comment upon them. They lie in wait until some great building blunder is exposed, and then rush into print with their usual wholesale condemnation of all that modern science has done (of which, of course, they know but little) to reduce the dangers of fire.

It is even difficult for those who have made a study of this subject to get reliable data of incipient fires in fire-proof buildings of the best class, of which so many have been recently erected. There are at the present day, doubtless, hundreds of cases of this kind that are never reported, and of which the facts are ascertained, if at all, long after their occurrence. They are regarded as of no importance by those immediately interested. It is the purpose of this article to mention a few of which descriptions have been obtained.

On the 30th of December, 1883, a very severe fire occurred in a four-story building on Monroe St., Chicago, occupied as a paper warehouse, and it was almost totally destroyed. This building surrounded two sides of the new nine-story Montauk Block, the first of the high fire-proof office buildings erected in Chicago. The wind drew the flames against the walls of the building above the fourth story, one of which was a dead wall, but the other was full of windows without any protection from iron shutters. The building was used as a water tower by the firemen to attack the fire in the burning building. The bricks of the Montauk Block were found, after the fire was out, to be a pale gray color from the intensity of the heat, the exposed glass was broken, and many of the window frames were burned out. In one room all the furniture and inside woodwork were burned, and the fire did not extend beyond this apartment. The floors of this building were built with 6 in. flat hollow tile arches between 6 in. I beams 4 ft. from centers. The partitions were built with 3½ in. hollow tiles and the columns and girders were protected by solid blocks of porous terra-cotta. Those on the columns were secured to the iron by screws. All the hollow tile were made of fire-clay, and it was one of the first buildings in which fire-clay had been used for making hollow tiles. All the tiles were made on a vertical sewer-pipe press in 1882. This was one of the earliest instances of the use of this powerful method of pressing hollow building tiles. The damage to the room did not extend beyond the plastering. The architects had taken the wise precaution of omittingall wood finish inside of the line of window frames and substituting plastering. The walls were not furred, consequently the burning of the window frames was less dangerous in communicating fire to the interior.

About two years after this a large apartment house was built on Euclid Avenue, Cleveland. It was eight stories high, the upper stories formed a Mansard roof, and the building stood free. All the floors were built with iron beams. The flat floor arches and partitions of six stories were built with hollow tiles made of red clay. The two upper stories were not fire-proofed. The building took fire on one of the lower floors about a year after it was built, and the fire ascended by some pipe chases, covered with wire lath and plaster, to the upper stories and roof, which were entirely consumed. The fire also descended through other chases to the lower floors and burned out several rooms. But it did not descend through any of the floor arches. Some of the ceilings and partitions in the lower stories were slightly damaged by fire, which would not have been the case had fire-clay been used.

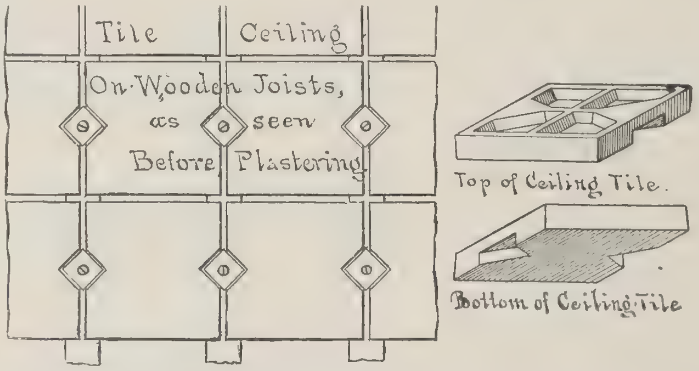
The owners rebuilt the upper stories with fire-proof material.

The Wilshire Building in the same city has been subjected to three fires, one of them of great violence. This is a large six-story and basement store and office building, having a retail clothing store on the first story and basement. The floors are all of wooden joists, 14 ins. from centers, and the ceilings are covered with 12 by 14 in. tiles of porous terra-cotta 2 ins. thick, being fastened in place with screws, having washers 2 ins. square, of $\frac{1}{16}$ in. iron, which are countersunk 1 in. into the tiles. The tiles are all hand made, and contain some fire-clay. The girders are all covered with porous terra-cotta, cast to fit their profiles, and the columns with porous terra-cotta blocks screwed to the iron. The screw-plates are all countersunk and the sinkage filled over with mortar. The first fire in this building was in a closet under a stairway, and was quickly subdued. The second fire was in an office on the fourth story, which was completely burned out. It was communicated to a room in the fifth story through the opening made for the steam and gas-pipes. The fire got behind the tiles of about one fourth of the ceiling and they dropped by the burning out of the screws. The fifth story room was damaged more than that in the fourth, but the ceiling resisted it successfully, and it did not break through where the exposed steam-pipes continued to the sixth story. This fire demonstrated the danger to be apprehended from running pipes of any kind through ceilings of tiles attached to wooden joists. But the value of the same tile ceilings was demonstrated by the third fire, which was the most severe of all. This occurred in the basement. As the first floor was level with the sidewalk, which was of prismatic lights, and similar floor lights were used in the main floor, the firemen could not get access to the basement until they had cut away the iron frames. The fire by this time had destroyed nearly all the goods and shelving in the basement. Most of the plastering fell but the tiles all remained perfect, and were newly plastered when repairs were made. There was no loss above the basement, though the fire was of considerable duration.

A six-story and basement retail store building, 115 by 170 ft. in dimension, was built by the late Martin Ryerson about the same time at the northeast corner of Wabash Avenue and Adams Street, Chicago. It was fire-proofed in the same manner as the last mentioned, and in addition the entire grand stairway, from basement to top floor, was fire-proofed on the under side and strings with porous terra-cotta, and finished with Keene's cement, the exposed treads and risers being of hard wood. The upper story, 16 ft. high, was used as a manufactory of straw hats and millinery goods, and was filled with very combustible materials, many board partitions having been put up by tenants. The building was supposed to have been struck by lightning, which set fire to the contents of this upper story in the vicinity of the head of the grand stairway, which was covered by an iron skylight. It was such a fire as would have consumed any ordinarily constructed store in a short time. The goods, boxes, shelving, and partitions of a large section of the upper story were burned, the skylight glass destroyed, and burning embers fell down the stairway well-hole before the firemen arrived. Their efforts were confined mostly to saving the goods. The ceiling of the top story was unbroken in every part. It was a suspended ceiling, and the roof was unprotected. Had it penetrated the blind attic the whole roof would have been destroyed.

When the firemen had extinguished the fire they tore down part of the tile ceiling with hooks, looking for concealed fire. But the joists showed no char. When the time came to make repairs, the contractors who had done the fire-proof work were called on for material to make good the damage done by the firemen. They returned an answer that no such material had been made for two years, because competition had resulted in its having been supplanted by a cheaper article. The contractors had to send the cheaper article. And thereby hangs a moral that need not be told.

The following illustration shows the detailed form and construction of the porous tile ceilings used in the Wilshire Building at Cleveland, and the Ryerson Building, Chicago. The tiles are 12 by 12 ins. and 12 by 14 ins., according to the spacing of the joists or furring strips, and 2 ins. thick at the edge; but, being hollowed out on the back and recessed on the face where the countersunk washers are used, they have a uniform thickness within the rim of 1 in. with two webs crossing at the back. They were all made by hand. The screws used are No. 14, 2½ ins. long, and the washers 2 ins. square and $\frac{1}{16}$ in. thick. The same kind of tiles are used in the American Bank-Note Engraving Company's building at New York, where they are secured directly to the 3 by 14 in. joists, placed 14 ins. from centers by ⅜ in. lag bolts 3 ins. long.



(*To be continued.*)

IN connection with the article that appeared in our April number anent Expert Fire-proofing Engineers, we are glad to have our attention called to the fact that Mr. Howard Constable, of New York City, member of the American Institute of Architects and the American Society of Civil Engineers, has given much study to the subject of fire-proof construction, having had for a long time a laboratory for testing accurately the various qualities necessary in materials to be used for the protection of buildings from fire. The success that has rewarded Mr. Constable's efforts justifies the statement that the science of fire resistance is not second in importance to that of skeleton construction.

Mortar and Concrete

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING.

(*Continuation of tests made by Prof. Cecil B. Smith.*)

NOW there are many occasions where it would not be wise to use anything but the best Portlands — such as laying mortar in extreme frost, or where great immediate strength is required, or for subaqueous work generally; but, on the other hand, no one doubts the *durability* of good natural cement. Works in Europe hundreds of years old, and all the work done in the United States and Canada previous to thirty years ago, are built with such mortars, and stand as witnesses of their lasting qualities.

Moreover, tests made on No. 1 natural cement (see Series III., frost tests) show that while it cannot be immediately exposed to extreme cold, yet when it is exposed, after it has set, it will resist frost thoroughly, and become stronger than if immersed in water at an ordinary temperature. There are thousands of situations where natural cement mortar, 1 cement, 2 sand, will be found amply strong for the purposes required, in which case it will be found cheaper than Portland mortar, 1 cement, 3 sand. Referring ahead to Series III. (frost), it will be seen that if mortars are tested in open air, the Portlands are weaker and naturals stronger than if the briquettes had been under water. This is a point of much importance, because if work is to be done which will not usually be submerged, as in damp foundations, abutments on land, culverts, etc., then tests made in open air will give results more favorable to naturals. In so many words our standard tests say: "Let us test all hydraulic cements under water; whether the mortar as used will be so or not, we will be on the safe side." This, as a generality, is doubtless best; but if we consider what a large proportion of cement is used in situations usually not submerged, it would seem more rational to test cements under conditions similar to those under which they are to be used in each case, be it in water *or air*.

As before mentioned, all the sand tests given in the Table (Table II.) were made by tamping the mortar lightly into the molds with an iron rammer weighing about ½ lb. and ½ in. square section.

This has been done in as nearly a uniform manner as possible. About three layers were tamped, and then a fourth layer smoothed off with a spatula. Every effort was directed toward uniformity in method, and, doubtless, some degree of accuracy was obtained; but it was felt that the best possible would only enable comparisons to be made in this laboratory, it would not enable any to be made with results obtained elsewhere.

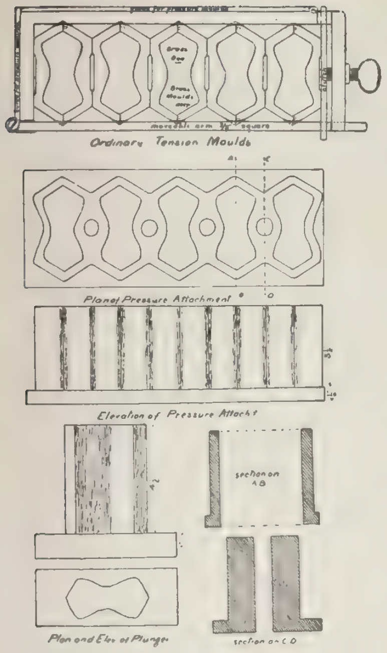
The Cement Committee of the Society (of which the writer was made a member, by invitation) advised that tests should be made under a pressure of 10 lbs. per square inch. It was not defined at the time whether this applied to sand tests only or to neat tests also; but the necessity for pressure is not so great in neat tests, because any one with ordinary skill and practise can make a good neat briquette, and a light pressure will not affect the result much, as will be shown farther on.

In November last the molds for applying pressure (see drawings), which were from a design of the writer's, modified by Mr. Withycombe, were completed, and since then several hundred briquettes

TABLE III.

Tested in tension. Pressure sand tests.

Brand.	Mixture.	Per cent. of water.	Pressure per square inch.	1 week tests, 1 air, 6 water.							4 week tests, 1 air, 27 water.						
				Lbs. per sq. in.			Weight when tested in ounces.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	Lbs. per sq. in.			Weight when tested in ounces.	Weight after two days' evaporation.	Per cent of evaporation.	Product col. 3 x col. 6.
				High-est.	Low-est.	Aver-age.					High-est.	Low-est.	Aver-age.				
No. 2	1 to 1	15	10	45	23	32½	4.56	3.98	12.63	410.4	71	39	59	4.64	4.01	13.49	795.9
		17½	10	165	106	136	5.26	4.84	7.98	1085.3	282	205	239½	5.32	4.95	7.03	1683.7
		20	10	130	94	117	5.56	5.08	8.62	1008.6	292	239	265½	5.52	5.17	6.34	1683.2
		22½	10	123	106	113½	5.54	4.99	9.88	1124.4	258	200	235	5.49	5.12	6.74	1583.9
No. 2	1 to 1	15	20	47	42	43½	4.79	4.05	15.52	675.1	95	70	84	4.99	4.22	15.40	1293.6
		17½	20	144	111	126½	5.37	4.92	8.38	1060.0	218	160	176½	5.27	4.83	8.35	1473.7
		20	20	157	90	114	5.07	5.13	9.63	1097.8	297	212	264	5.62	5.28	6.12	1615.6
		22½	20	126	110	119	5.54	5.03	9.28	1104.3	295	234	262	5.56	5.21	6.29	1648.0
No. 15	1 to 1	15	10	86	40	62½	4.92	4.42	10.46	653.7	112	98	104	5.04	4.41	12.50	1300.0
		17½	10	60	37	52	5.14	4.60	10.50	546.0	......	....	......	....	....	......	....
		20	10	149	108	133	5.60	5.12	8.46	1125.1	......	....	......	....	....	......	....
		22½	10	129	120	125	5.68	5.19	8.76	1095.1	......	....	......	....	....	......	....
No. 15	1 to 1	15	20	49	42	45	4.94	4.18	15.46	695.7	......	...	....	....	....	......	....
		17½	20	184	145	166½	5.62	5.28	6.61	1100.5	......	....	...	....	....	......	....
		20	20	146	114	135½	5.63	5.17	8.20	1111.1	......	....	......	....	....	......	....
		22½	20	130	108	118	5.72	5.25	8.22	970.0	......	....	......	....	....	......	....
No. 15	3 to 1	15	10	20	14	16½	4.75	4.03	15.21	251.0	35	19	28	4.61	3.88	15.88	444.6
		17½	10	12	5	7	4.59	3.92	14.66	102.6	48	32	40	4.66	4.15	11.03	441.2
		20	10	13	7	11	4.73	4.17	11.79	129.7	23	5	15	4.86	4.24	12.75	191.2
No. 15	3 to 1	15	20	23	9	16	4.64	3.97	14.48	231.7	55	28	38	4.56	4.01	12.15	461.7
		17½	20	7	2	5	....	....	....	....	40	25	33½	4.74	4.23	10.80	361.8
		20	20	17	8	12½	4.85	4.28	11.75	146.9	28	19	24	4.89	4.36	10.80	259.2
No. 9	3 to 1	15	10	25	14	19	4.37	3.81	12.77	242.6	71	58	63	4.54	3.89	14.24	897.1
		17½	10	35	18	27	4.49	4.07	9.35	252.4	106	92	96	4.72	4.24	10.17	976.3
		20	10	27	20	23½	4.68	4.08	12.91	303.4	134	101	120	4.65	4.18	10.14	1218.8
		22½	10	27	22	24½	4.85	4.23	12.86	315.1	88	74	79	4.70	4.16	11.49	907.7
		25	10	11	8	10	4.81	4.13	14.13	141.3	53	33	46½	4.73	4.11	13.18	612.9
No. 9	3 to 1	15	20	37	33	34	4.66	4.05	13.22	459.5	86	62	71½	4.69	4.15	12.22	873.7
		17½	20	33	20	27½	4.53	4.10	9.54	262.3	124	103	114½	4.75	4.27	10.15	1162.1
		20	20	29	25	26½	4.8	4.19	12.78	338.7	143	109	127	4.69	4.26	9.17	1164.5
		22½	20	25	22	23	4.86	4.27	12.06	277.4	103	87	95½	4.81	4.28	11.02	1052.4
		25	20	27	22	25	4.80	4.18	12.89	324.4	53	44	49	4.70	4.09	12.94	634.1
No. 10	3 to 1	15	10	37	30	34½	4.70	4.18	11.07	381.9	59	51	55½	4.72	4.18	12.27	681.0
		17½	10	43	22	31½	4.67	4.12	11.69	368.2	87	63	70	4.84	4.35	10.05	703.5
		20	10	48	32	37½	4.79	4.24	11.41	427.8	65	62	63½	4.89	4.32	11.68	741.6
		22½	10	34	27	30	4.95	4.33	12.45	373.5	50	38	44½	4.88	4.22	13.48	600.0
		25	10	33	15	23½	4.92	4.27	13.14	308.7	34	23	28½	4.86	4.15	12.94	368.8
No. 10	3 to 1	15	20	41	27	33½	4.68	4.11	12.18	408.0	67	52	61	4.95	4.40	11.04	673.4
		17½	20	37	16	27	4.65	4.08	12.13	327.5	88	47	68	4.84	4.31	10.96	745.3
		20	20	42	31	35	4.82	4.24	11.96	424.5	84	56	71	4.97	4.42	11.03	783.1
		22½	20	36	23	29½	4.90	4.28	12.65	373.1	85	70	75	4.90	4.35	11.23	842.2
		25	20	33	27	31	5.00	4.35	13.06	403.0	58	34	48	4.85	4.27	11.92	572.2


Ordinary Tension Moulds
Brass Moulds
Plane of Pressure Attachment
A
B
C
D
Elevation of Pressure Attach t
section on AB
Plan and Elev. of Plunger
section on C D

have been made with them. It would seem a simple matter to mix up mortar, put it under a plunger, and by putting on 10 lbs. per square inch, make briquettes; but theory and practise must be fellow-laborers. Now, 12 per cent. of water is considered the correct thing in 3 to 1 mixtures, but with this amount, the mortar would not pack at all in a closed mold under so light a dead pressure, and it is light dead pressure that is wanted; even 20 lbs. per square inch was of no greater effect; then 15 per cent. of water was tried, with very little better results.

It was finally concluded to try several series with different percentages of water, and thereby determine the best per cent. for making a good briquette.

These series (see Table III.) ran from 15 per cent. to 25 per cent. of water, and were for 10 lbs. and 20 lbs. pressure per square inch for 1 week and 4 weeks, and each result tabulated is the average of 5 briquettes, and the whole table the result of 77 experiments, or 385 briquettes.

The result, to the author's mind, is definite; 20 per cent. of water is just sufficient to make a plastic mortar, so that a good briquette can be formed while more water tends to drown the cement, and make it weaker at both the 1 week and 4 week tests, although longer tests would probably show a recovery in this respect.

TABLE IV.

CONDENSED SUMMARY OF PRESSURE SAND TESTS.

Put in molds with 20% water, 20 lbs. per square inch.

Brand.	Mixture.	1 week tests, 1 air, 6 water. Lbs. per sq. in. Highest.	Lowest.	Average.	Weight when tested.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	4 week tests, 1 air, 27 days water. Lbs. per sq. in. Highest.	Lowest.	Average.	Weight when tested.	Weight after two days' evaporation.	Per cent. of evaporation.	Product col. 3 x col. 6.	REMARKS.
No. 1	1 to 1	75	46	58	5.25	4.55	13.33	773.1	102	80	93	5.32	4.70	11.73	1090.9	Temp. of air, 60° F.
No. 2	1 to 1	157	90	114	5.67	5.13	9.63	1097.8	297	212	164	5.62	5.28	6.12	1615.6	" " 60° F.
No. 15	1 to 1	146	114	135½	5.63	5.17	8.20	1111.1	......	......	......	......	......	......	......	" " 61 F.
No. 15	3 to 1	17	8	12½	4.85	4.28	11.75	146.9	28	19	24	4.89	4.36	10.80	259.2	" " {60 F. (1) {60 F. (2)
No. 3	3 to 1	19	8	13	4.74	4.17	12.06	156.8	52	37	47	4.48	3.89	13.20	620.0	" " 63 F.
No. 9	3 to 1	29	25	26½	4.80	4.19	12.78	338.7	143	109	127	4.69	4.26	9.17	1164.5	" " {65 F. (1) {58 F. (2)
No. 10	3 to 1	42	31	35	4.82	4.24	11.96	424.5	84	56	71	4.97	4.42	11.03	783.2	" " {68 F. (1) {59 F. (2)
No. 8	3 to 1	34	25	30½	......	......	......	......	85	75	80	4.99	4.41	11.55	924.0	" " 54 F.
No. 5	3 to 1	15	12	14	4.78	4.12	13.70	191.8	58	43	50	5.13	4.36	15.01	750.0	" " 74 F.
No. 4	3 to 1	52	30	33½	4.94	4.37	[illegible]	457.4	118	83	103	5.02	4.49	10.56	1087.7	" " 61 F.
No. [illegible]	3 to 1	77	58	[illegible]	4.79	4.09	[illegible]	1015.3	143	101	129	4.88	......	......	......	" " 65 F.
No. [illegible]	3 to 1	83	74	[illegible]	4.77	3.97	[illegible]	1313.5	139	118	128	4.90	4.28	12.65	1619.2	" " 64 F.
No. 11	3 to 1	25	15	[illegible]	4.56	4.13	9.51	180.7	46	37	41½	4.85	4.18	13.90	576.8	" " 48 F.
No. 14	3 to 1	15	8	[illegible]	4.69	......	......	......	36	24	30	4.88	4.16	14.76	442.8	" " 53 F.

This 20 per cent. applies to 1 to 1 and 3 to 1 mixtures, and will probably be about right for 2 to 1 also, if it is desired to make such tests. It is conclusive from the table that if any standard test under light pressure is to be adopted for sand tests, 20 per cent. of water must be prescribed as a definite part of the test, and in this way perfect uniformity obtained. It is understood that the sand used is standard sand dry and sharp, a finer or rounder sand would allow less water to be used. This amount of water, while greater than that usually given by authorities whose method of making sand briquettes is by some severe hammering process (*e. q.*, German) is still close to the amount used in practise.

Even at the risk of repetition, it is worth saying again, that plastic mortar made with 20 per cent. of water is close to practise, and will give regular and accurate tests if put into molds under light pressure. The amount of this pressure does not seem to be of such great importance, but 20 lbs. per square inch gives rather sharper-edged briquettes, with about the same variation in uniformity and the same tensile strength per square inch. This is equivalent to 20 feet of masonry, which, of course, is more than practise would give; but the tests do not vary to any extent when compared with those made with 10 lbs. per square inch. Therefore, it is not deemed of sufficient importance to sacrifice good manual results. Therefore, 20 lbs. per square inch pressure and 20 per cent. water was adopted about 1 month ago, and the following results obtained (Table IV.)

(*To be continued.*)

McGill University, Montreal, Nov. 5, 1896.

Editor Brickbuilder.

Dear Sir: Knowing the interest that you take in cement testing, I have thought that some results obtained in our cement laboratory during the last year or two might become acceptable to some of your readers. Since our Canadian Society of Civil Engineers cement standards were fixed in 1895, the writer has carried out all tests as nearly as possible according to these standards, which includes specific gravity, residues, blowing or checking test by submergence in hot water for 24 hours, and strength tests both neat and 3 to 1 with standard crushed quartz sand. These last tests are to be carried out in a way different from that prescribed in other countries, namely, that the briquettes of 3 to 1 sand are to be formed by a dead pressure of 20 lbs. per square inch, and that the mortar is to be of a soft consistency, similar to mason's mortar, which the writer, in his series of tests in 1893–94 (which had been the basis of the society's action), had found to be 20 per cent. of water added. With a view to comparison, however, parallel tests of rammed 3 to 1 briquettes with 12 per cent. of water have been made in many cases,

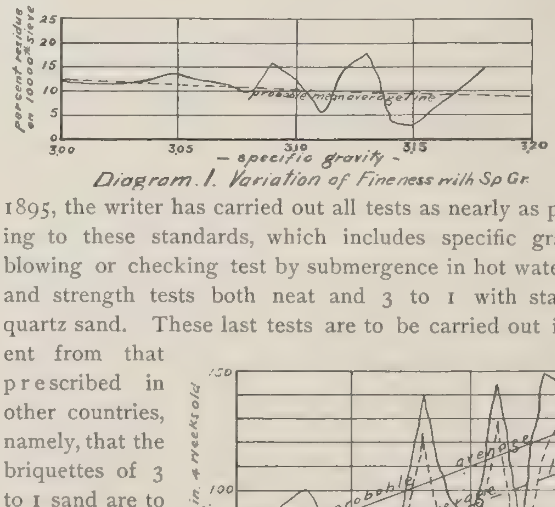


Diagram. I. Variation of Fineness with Sp Gr.

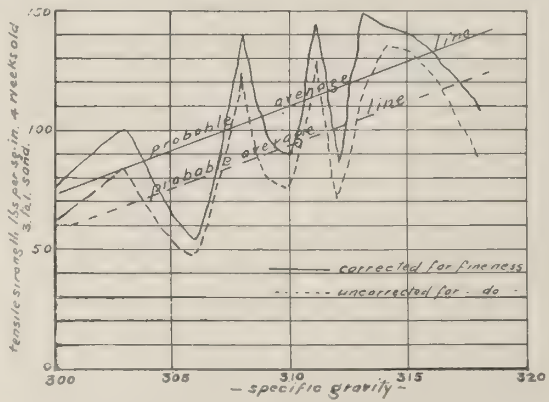


Diagram. 2. Increase of Strength with Sp Gr.

and the table, here presented, contains the results of 32 tests in which this has been done. At first sight this table presents a very heterogeneous appearance, and such might be expected of cements coming from 7 different countries, of probably different chemical compositions, and of different ages, but if we plot them as diagrams in various ways many interesting facts appear. The table was arranged according to 4 week 3 to 1 pressed sand strengths.

Referring to Diagram 1, it will be seen that as the specific gravity increases, the amount of residue on a 10,000 mesh sieve remains nearly constant, if anything, decreasing. At first sight this might appear strange, but it may be easily accounted for by the fact that those manufacturers who burn their clinker well have sense enough to grind well also, even though it is much harder to do than with the underburnt products. The next deduction that may be drawn from diagram 1 is that 10 per cent residue on 10,000 mesh sieve is a fair average and, therefore, easily obtainable. Any specification permitting more than 10 per cent. residue on this sieve is not up to date. The finest cement, No. 8, with $\frac{9}{10}$ per cent. residue, shows what can be obtained if sought for. The writer lays stress on this point because a recent triangular discussion in the *Engineering News* elicited conflicting opinions on this subject.

Diagram 2 also shows clearly the fallacy of a statement made in the same discussion, "that the specific gravity test was useless." In this diagram the strength of 3 to 1 sand tests increases very rapidly with the specific gravity. In order to partially eliminate the question of fineness, calculations were made (see corrected diagram line) in which a mortar made of a cement having 5 per cent. residue on 10,000 mesh sieve was considered to be a 305 to 95 mortar and an estimate made of the corresponding 3 to 1 strength; this is, of course, only a rough elimination, but it does not appreciably affect the diagram, the corrected and uncorrected lines being parallel.

The diagram also indicates that a specific gravity of less than 3.07 will seriously affect the sand tests, care being taken, however, to know the age of the cement, as an old cement (Portland) decreases in specific gravity. A range of specific gravity of 3.08 to 3.15 is wide enough to cover most good cements.

Diagram 3 illustrates the well-known effect of grinding. It would appear from this diagram that grinding is *well worth paying for* if strength is the thing required. The average of 14 cements having less than 10 per cent. residue is 121 lbs. per square inch, 3 to 1 pressed sand tests, while the average of 18 similar tests on cements having from 10 to 30 per cent. residue on same sieve is only 73 lbs., or only $\frac{3}{5}$ as much.

Coming now to Diagrams 4 and 5, an examination will show that the ratio between the neat and sand strengths decreases as the cement increases in strength; in other words, the *definition* is more rapid as to strength with sand tests than with neat tests. It is a fact that high neat tensile strength is a rough indication that the sand strength will be high also. The table shows this, but the diagram clearly points out the quicker or more sensitive fluctuation of sand tests as compared with neat. At 50 lbs. the neat strength is over 8 times as great, but at 200 lbs. the neat strength is only 3 times as great; or, while the sand strength has increased 300 per cent., the neat strength has only increased 50 per cent. Diagrams 4 and 5 also show that the tests by pressure are more sensitive than those made by ramming. This might be expected, as no extraneous effect of severe ramming interferes with the adhesive quality of the cement. With the higher grades of cement the strength at 4 weeks is nearly as great as though the briquettes were rammed, but with poor, coarse cements the strength falls very rapidly. Some time ago the writer ventured to lay before your readers an account of this method of testing sand mixtures, and until the superiority of the method is questioned, will refrain from further details.

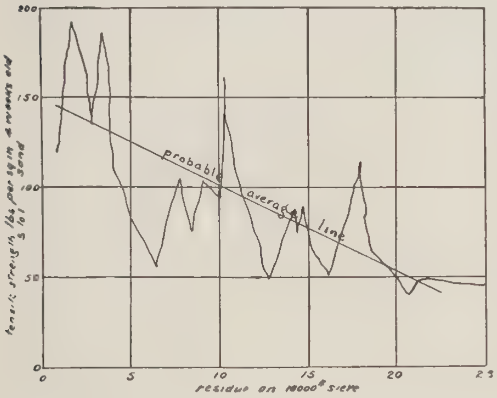


Diagram 3. Decrease of Strength with Fineness

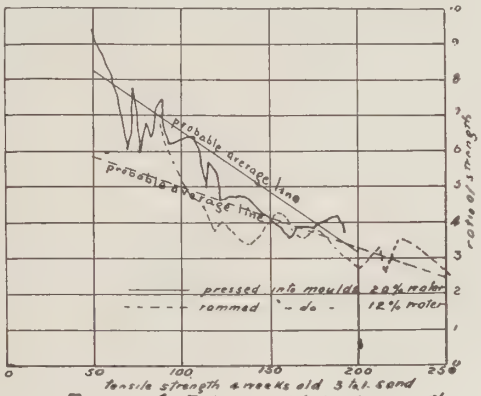


Diagram 4. Ratio of Neat to Sand Strength

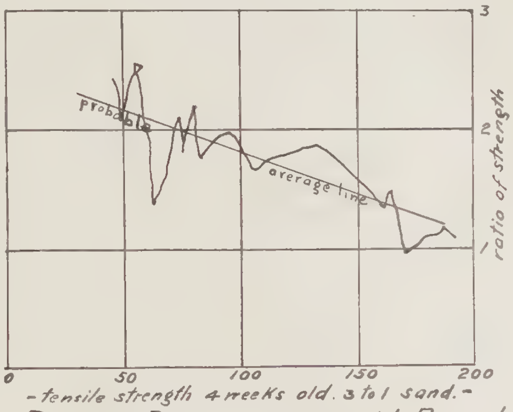


Diagram 5. Ratio of Rammed to Pressed. 3 to 1. - Sand Tests.

RESULTS OF CEMENT TESTS.

Tabulated in order of strength, 3 sand, 1 cement, 20 per cent. water, 20 lbs. pressure, 4 weeks' test.

No.	Country.	Specific Gravity.	Per cent. Residue on No. 100 Sieve.	Tensile Strength.		Tensile Strength.		Tensile Strength.	
				Neat 1 wk.	Neat 4 wks.	3 to 1 1 wk.	3 to 1 4 wks.	3 to 1 1 wk.	3 to 1 4 wks.
						20 per cent. water 20 lbs. pressure in molding.		12 per cent. water rammed into molds.	
1	Denmark	3.11	1.7	596	706	71	193	137	212
2	United States.	3.08	3.5	775	790	98	187	199	224
3	Canada	3.04	3.8	492	656	90	170	109	160
4	Belgium	3.08	10.3	561	631	110	165	178	258
5	Canada	3.14	2.6	479	566	109	161	167	217
6	Germany	3.15	2.8	482	637	64	134	145	252
7	England	3.09	9.2	432	551	81	122	169	216
8	Canada	3.12	0.9	482	625	82	121	....	....
9	Canada	3.13	18.0	424	653	53	115	....	....
10	Canada	3.14	4.0	467	558	61	114	132	204
11	Germany	3.07	8 0	612	682	71	106	112	175
12	Belgium	3.03	10.1	493	582	54	94	113	187
13	Belgium	3.09	14.8	498	602	45	90	90	171
14	Canada	3.18	14.3	515	658	47	88	....	....
15	Germany	3.10	9.2	570	655	53	87	....	....
16	Belgium	3.07	7.1	418	573	50	83	108	164
17	Canada	3.11	8.2	420	495	44	83	88	122
18	Canada	3.08	13.7	466	549	40	80	118	178
19	France	3 03	13.7	385	450	44	76	86	136
20	England	3.07	14.5	420	489	42	74	....	....
21	England	3.12	8.5	519	665	36	74	114	155
22	Belgium	3.08	12.0	380	422	31	70	72	116
23	England	3.09	18.5	336	447	31	65	......	....
24	Canada	3.10	15.3	510	608	....	64	....	88
25	Belgium	3.00	12.2	385	485	30	62	....	....
26	Belgium	3.05	6.5	369	481	33	55	81	141
27	Belgium	3.07	16.3	398	484	30	50	60	105
28	England	3.05	21.3	286	392	25	48	....	....
29	Belgium	3.06	12.8	324	511	21	48	55	....
30	Canada	3.12	20.2	265	....	25	46	71	111
31	Canada	3.12	30.0	350	435	21	41	....	....
32	England	3.09	20.7	361	397	30	39	....	....

Doubtless many of your readers will find other interesting deductions from the table and diagrams. Those which the writer has commented on have seemed to him the most obvious.

Yours respectfully,

CECIL B. SMITH.

The Masons' Department.

CONDUCTED IN THE INTERESTS OF THE MASON AND THE CONTRACTOR FOR BRICKWORK.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX. (*Continued.*)

EXTRAS.

NO one with experience in building matters will contradict the statement that *extras* are the cause of more trouble between clients, architects, and builders than all other questions which arise under a building contract put together. As the reasons why extras, when they are allowed to materialize, usually cause more or less embarrassment, have been considered in a previous paper, it is unnecessary to review this phase of the matter. It is important, however, to note that extras are caused in the large majority of cases by either the owner or architect, on account of omissions or changes in the plans or specifications; and when the opportunity is given the contractor to become an interested party, he usually improves it, and adds to the already existing difficulties and disagreements through insufficient allowances or excessive charges.

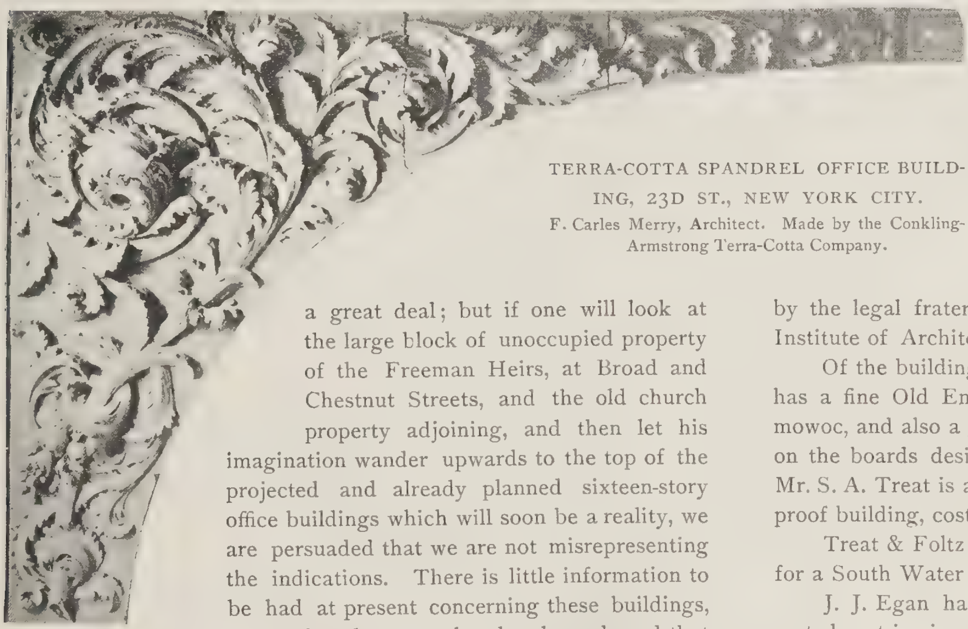
Extras in general may be divided as follows: First, what may be called legitimate ones. Second, those which are the result of oversight, inexperience, or ignorance. And third, those which are occasioned by misunderstandings among the parties concerned, which are usually between the client and architect. Every one knows, or should be made to realize before undertaking in any capacity the construction of a building of any considerable size, that such an enterprise involves the combining of so many distinct trades and interests that it is practically impossible for the architect, within the limited time which is allowed for him to draw up the plans and specifications, to provide for all possible contingencies which will develop during the progress of the work. This is in itself sufficient reason why the owner is usually called upon to pay for a certain amount of work in excess of the stipulated sum, and is a perfectly legitimate risk which an owner assumes when he undertakes to build. It is therefore plainly the duty of the architect, realizing that he is no more infallible than the rest of mankind, to acquaint his client of the fact and prepare him for the inevitable. If this precaution is taken, any reasonable man will recognize the justice of it; and so far as unreasonable clients are concerned, they are both unprofitable and undesirable. The amount of legitimate extras on ordinary work average themselves so that an experienced architect can, if he so desires, prepare his client for about the expenditure he will be called upon to make to meet these contingencies. An expenditure for such extras up to ten per cent. of the contract sum is not usually considered excessive, but this limit should not be held to include changes or additions of any importance made by the client or architect, which, of course, widely vary under different conditions and circumstances. Extras which are the result of oversight, inexperience, or ignorance, it is hardly possible to consider in detail, although they are the most aggravating which the architect is called upon to face, for there is usually no valid excuse for their existence. It is, however, important to call attention to the fact that many of the extras of this class are the result of conflicting interests; that is to say, where work of one kind interferes with another and a change is necessary to reconcile them; or, on the other hand, where two things fail to come together and extra work is required to complete the piece of labor. Trouble of this sort has been greatly increased of late by the complication of what are commonly known as "fixtures" (*i. e.*, heating, plumbing, electric work, elevators, etc.), which have developed so rapidly and have become so complicated that the architect has been hardly able to keep pace with the changes and improvements. The employment of experts on such work does not serve to simplify matters as one would expect it might, for each expert is inclined to provide for his own particular plant without considering the fact that there are other interests besides his own which must be considered. The architect who wishes to avoid extras from this cause must impress upon each expert the fact that he must confine his work within certain limits, lay out his plant so that it will not interfere with the construction or artistic requirements of the problem, and, finally and most important of all, that it is the duty of each expert to so familiarize himself with the general and special requirements of the problem at hand that he knows of his own knowledge that his particular work can be put in without conflicting with any other work, and if any conflict is found to exist or is liable to develop, he must call attention to the fact, so the matter can be considered and worked out before the work is so far advanced that the change involves additional expense. And, finally, the fact cannot be too strongly emphasized that extras of this class may be reduced to a minimum by the writing of careful and complete specifications, which is a department of architectural practise which seldom receives the attention it demands. There is a theory which is too commonly found, even among architects themselves, that while it takes a person of some little ability to design, almost any one can write specifications; but, as a matter of fact, the art of writing a complete and satisfactory specification requires a thorough knowledge of both the artistic and practical requirements of the problem, and many designs which had promised well on paper have failed in execution, because the materials and methods of execution have not been intelligently described. The fact that specification writing is often delegated to a subordinate is also responsible for extras, for it is by no means uncommon for an architect on his tour of inspection to find work actually executed of different material, and in a manner entirely at variance with the original intention, in which case, if the work is important and the architect desires to have it right, a change must be made. This involves an extra; and as the architect's commission is not sufficiently large to admit of much generosity in such directions, the owner is requested to foot the bill; but it is usually hard, when the facts become known, for him to see the justice of the claim. The architect, who wishes to avoid the embarrassments which extras of this kind are sure to bring, must, therefore, first of all, give serious attention to the writing of his specifications, and use every precaution to make them complete and accurate. "Specification reminders" are a most useful aid in preventing omissions, and if, on the completion of each piece of work, the questions which have arisen on it are noted in the office copy of the specification opposite the proper heading, the architect will in time accumulate sufficient data to enable him to reduce to the minimum the extra, resulting from omissions. Extras of the third class, those resulting from misunderstandings, are usually caused by the owners thinking certain work was included in the contract, whereas in reality such was not the intention of the architect. Such misunderstandings may seem at first thought entirely unnecessary and unexcusable, but while as a matter of fact, they are of frequent occurrence, they can be easily avoided by always making it a rule that a client shall read the specifications through and have such portions as are not clear explained to him. Some architects adopt the additional precaution of printing on the title-page of a general specification the items, if there be any, which are not included.

(*To be continued.*)

BRICKWORK constructed in cold weather, using ordinary mortar prepared with warm water, proves very unsatisfactory in point of resisting power; nor is any improvement effected by dissolving in water ½ per cent. of calcium chloride. Excellent results are obtained when the mortar is produced with warm water containing in solution 1¾ per cent. of common salt. The addition of freshly slaked lime to ordinary mortar results in a satisfactory degree of durability; but still better results are obtained by the exclusive use of freshly slaked lime, especially when employed in conjunction with calcium chloride. An admixture of Portland cement with common mortar increased its resisting power to frost.— *Thon Industrie Zeitung.*

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

PHILADELPHIA.— With the expected restoration of confidence in business circles, Philadelphia is promised some of the largest building projects which it has ever known. This is saying a great deal; but if one will look at the large block of unoccupied property of the Freeman Heirs, at Broad and Chestnut Streets, and the old church property adjoining, and then let his imagination wander upwards to the top of the projected and already planned sixteen-story office buildings which will soon be a reality, we are persuaded that we are not misrepresenting the indications. There is little information to be had at present concerning these buildings, except that they are already planned, and that the owners of the church property had in contemplation a twelve-story building, but hearing of the intention of the owners or lessees of the other part of the property to put up sixteen stories, they have determined to add four stories more, and conform their building to the other.



TERRA-COTTA SPANDREL OFFICE BUILDING, 23D ST., NEW YORK CITY.
F. Carles Merry, Architect. Made by the Conkling-Armstrong Terra-Cotta Company.

The Witherspoon Building, named in honor of Rev. John Witherspoon, a noted Presbyterian of a century ago, was the scene of a formal corner-stone laying within the month just passed; it is being built by the Presbyterian Board of Publication, and will cost $1,000,000. It will be ten stories in height, and cover an area of 230 by 75 ft., on the corner of Walnut and Juniper Streets. It is expected to be ready for occupancy about the first of August next. Architect Joseph M. Houston prepared the drawings and will superintend the construction of the work.

The same architect reports having several large projects of a similar kind in his office, which are only awaiting a revival of business to become realities.

As if to crown the list, and add still one more to the long-looked-for improvements of the city, comes the plan for the new mint, which is, we are told, soon to grace the corner of 16th and Spring Garden Steets; Architect Aiken has at last unfolded his plans and tells what the structure will be like.

It shall be the finest building, architecturally, which the Government has ever erected. The principal front will be on Spring Garden Street, and will be about 316 ft. long, the frontage on 16th and 17th Streets being 180 ft. It is built in the shape of a hollow square, thus giving plenty of light to the interior rooms. The design is classic, and the entire building is surrounded by a terrace 40 ft. wide, except the rear, which fronts directly upon Buttonwood Street. The materials shall be granite and white marble, and the interior is very conveniently and rationally laid out. It is said that the money for its erection is available, and work will be commenced in the near future.

CHICAGO. — There is a decidedly better feeling on the part of building interests since the election. How far the sentiment is justifiable remains to be seen. One evidence of the dependence of new projects on the outcome of the political situation is a million-dollar building, the plans for which were being rushed by Jenney & Mundie before election. Bids and options were to be obtained on pre-election prices of steel, etc., to forestall the stiffening of prices anticipated in the event of McKinley's election. Had Bryan been elected, the whole enterprise would have lain still indefinitely. The building referred to is The Fair, which was planned several years ago for sixteen stories in height, and to cover an area 190 by 350 ft., fronting on State, Adams, and Dearborn Streets. Half of this was built eight stories high, and now the other half will go up to complete a fine block, impressive in size, even without the upper eight stories. The entire exterior is to be brick and terra-cotta.

The proposition to put three additional stories on the old court house was encouraged by the legal fraternity, but the people voted on the advice of the Institute of Architects and the Real Estate Board, and vetoed it.

Of the buildings to be erected in the near future, Howard Shaw has a fine Old English half timber and brick residence at Oconomowoc, and also a golf club house at the same place. Mr. Shaw has on the boards designs for a new manufacturing building, for which Mr. S. A. Treat is associate architect. This will be a seven-story fire-proof building, costing about $100,000.

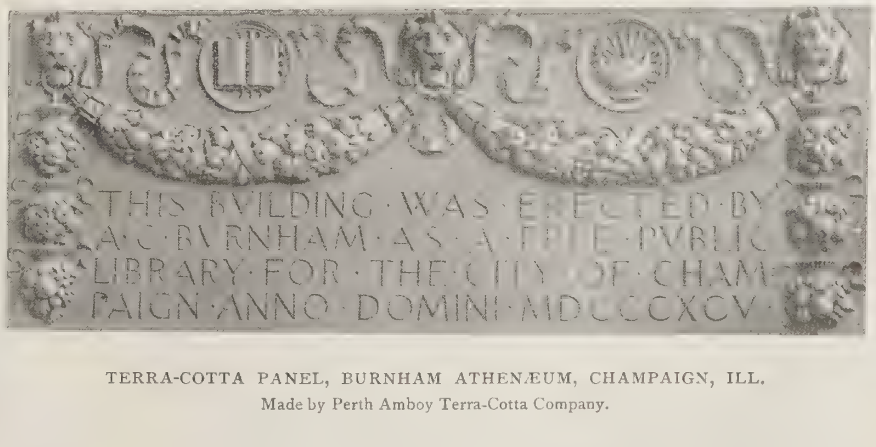
Treat & Foltz have on hand a new terra-cotta and brick front for a South Water Street warehouse.

J. J. Egan has designed a "Home for the Aged." The estimated cost is given as $65,000.

Jenney & Mundie have designed a $50,000 apartment building, which is to have an exterior of buff brick and white terra-cotta, and fire-proof interior construction. The same architects have several residences on the boards.

ST. LOUIS. — Between carnivals, national conventions in bunches, and the excitement of the political campaign, we have had little time to worry about business inactivity.

Turning from this transient excitement, we are glad to be once again greeted by the hum and throb of legitimate business activity, for, as a direct result of the election, signs of returning prosperity are everywhere manifesting themselves.


THIS·BVILDING·WAS·ERECTED·BY
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TERRA-COTTA PANEL, BURNHAM ATHENÆUM, CHAMPAIGN, ILL.
Made by Perth Amboy Terra-Cotta Company.

It is generally expected that much of the work that had been started, also work in all stages of development on the boards which was discontinued awaiting the result of the election, will now go ahead, although the lateness of the season may be a retarding factor.

R. W. Morrison has completed the large commercial building on

Washington Avenue for the Tindell Estate. It is seven stories, — two of red granite, five of gray brick and terra-cotta; slow-burning construction.

MADE BY THE NEW JERSEY TERRA-COTTA COMPANY, FOR Y. M. C. A. BUILDING, NEW YORK CITY.
James E. Ware, Architect.

A new seven-story building on Fourth Street, for the Collier Estate, — Shepley, Rutan & Coolidge, architects, — is interesting because of the grouping of the windows, those in the center having a heavy terra-cotta band around them which extends up through the several stories. A tier of smaller windows is on each end and across the seventh story. Gray brick and terra-cotta were employed.

PITTSBURG. — The advent of the office building in this city has created a tenancy never before known. Twelve or fifteen years ago such a thing as an office building here was unknown. To-day there are over fifty first-class office buildings, counting only those which have passenger elevator service, and otherwise fully equipped with the better and later improvements for comfort of the tenants. Nearly eighty per cent. of the offices in these buildings are always rented and bring the percentage counted on by the owners. Those office buildings that fail to reach that limit are either improperly managed or are situated in poor localities.

Geo. Orth & Bros. and Peabody & Stearns are the architects who are in competition for plans of a bank building for the National Bank of Western Pennsylvania, which will be erected here.

Architects E. J. Carlisle & Co. will soon prepare plans for an eight-room brick schoolhouse for the Eighteenth Ward, to cost $25,000.

Pitcairn Borough will build a new brick and stone schoolhouse, to cost about $20,000.

It is reported that Architect Miss Elise Mercur has the plans for the clubhouse of the Twentieth Century Club, to be erected here at a cost of $75,000.

Architect F. C. Sauer is to prepare plans for a brick and stone church for St. Joseph's Roman Catholic congregation in Allegheny, to cost about $50,000.

Architect Chas. Bickel has submitted plans for the German Evangelical Lutheran Church on Mt. Washington. It will be of brick, and cost about $75,000.

The plans of Architect T. P. Chandler, Jr., of Philadelphia, Penn., have been adopted for the new edifice of the Third Presbyterian Church, to be erected in the East End, at a cost of $200,000.

Architects Alden & Harlow have prepared plans for a Lutheran Church, to be erected at Vandergrift, to cost about $15,000.

Dr. J. B. Herron has donated a very valuable piece of property on Sandusky Street, Allegheny, for the new United Presbyterian Hospital. Plans have been asked for from architects. It is expected to cost $75,000.

Architect W. H. Sims has completed plans for a $20,000 residence for Geo. Baum, on North Negley Avenue.

MINNEAPOLIS. — Up to November 3, building matters were the quietest since last January. The very next day, when McKinley's election seemed certain, there was an immediate move towards carrying out some of the numerous projects which were held in abeyance pending result of elections. The assurance of the result has reassured capitalists and property owners. Gold came out of hiding-places and was offered for deposit at all the banks.

Of course we cannot hope for a very large revival in our business before spring, then there is no doubt whatever of the result. We are going to have the best year in the Northwest in past ten years. So much work for a year or two past has "hung fire" that its immediate carrying out is enough of itself to warrant this assertion, and we know that there will be a great deal of new work, that is as yet in embryo.

We voted on propositions to issue school bonds for $200,000. This was carried by overwhelming majority, and insures the erection of four or five new school buildings here next year, which are badly needed, notwithstanding the fact that three were erected this year, and same number previous year.

T. B. Walker began the erection of a $30,000 business building the second morning after the election, a building 85 by 125 ft. A number of residences costing from $2,500 to $10,000 are now assured this year, which were held back pending result of election. There is every inducement for a man who has the means to avail himself of the present low prices of labor and materials of every kind, and this fact is fully realized.

There is plenty of money available now, whereas a week ago it was impossible to get any sort of an accommodation, and gold could not be had on any terms. The day following election the banks paid it out without reserve. The croakings of would-be repudiationists is silenced at the very outset by the easy and confident feeling which prevails generally, and only three days after election. Instead of reducing force and production, the very reverse is the order now, and there is a strong liability of shortage in labor and materials when spring arrives, owing to the sudden and heavy demand that will be made in all lines.

At the regular monthly meeting of the Minnesota Chapter, A. I. A., held on evening of November 6, at West Hotel, a paper was read by E. P. Overmire on the "Inception of Modern Steel Construction," followed by a general discussion of the subject. The writer of this paper contends, after investigation, that the credit for having first devised this system of construction belongs to L. S. Buffington, Architect, of Minneapolis, he having patented his invention in 1887, at which time his claims and the twenty-eight-story

CAPITAL FOR GARFIELD PARK BAND STAND, CHICAGO.
J. L. Silsbee, Architect. Made by Northwestern Terra-Cotta Company.

building he designed were published and excited ridicule all over the country, architectural periodicals, as well as daily newspapers, joining in the chorus. A number present expressed themselves as of the same opinion as the author of the paper, and also thought that justice should be done the inventor.

TRADE PUBLICATIONS.

THE Philadelphia & Boston Face Brick Company has just issued a revised catalog of molded and ornamental brick. We are confident that architects and builders will appreciate the effort to create a sufficiently extensive variety of carefully modeled forms to carry out the most ornate work of Renaissance architecture in brickwork. The shapes are admirably chosen and seem to provide for almost every probable combination which would be encountered in ordinary commercial structures, while in addition there are a number of special patterns which can be adapted to decorative effects in combination with fireplaces and elaborations of detail on quite an extensive scale. The possibilities of molded brick have been fully appreciated by some of our architects, who have been able to obtain very satisfactory results at a minimum expenditure, and the Philadelphia & Boston Company has studied so carefully what might be called the standard requirements that the forms have a familiar, copiable aspect which make them seem like one's own thoughts. The company is to be congratulated upon the improvements made in its processes and designs.

TRADE DIRECTORIES FOR 1896–97.

THE ARCHITECTS' DIRECTORY, containing a list of the architects in the United States and Canada, classified by States and towns, with the architectural associations to which they belong indicated against each name. Prepared with the greatest care to secure accuracy both in names and location. Together with a classified index of prominent dealers and manufacturers of building materials and appliances. Price, $1.00. William T. Comstock, 23 Warren Street, New York.

HENDRICKS' ARCHITECTS' AND BUILDERS' GUIDE AND CONTRACTORS' DIRECTORY OF AMERICA, for builders, contractors, manufacturers, and dealers in all kinds of building supplies. A complete directory of all the construction industries of the country, containing over 170,000 names, addresses, and business classifications, comprising builders and contractors of material and construction in the building and kindred industries. With full lists of the manufacturers of and dealers in everything employed in the manufacture of material and apparatus used in these industries — from the raw material to the manufactured article, and from the producer to the consumer. Price, $5.00. Published by Samuel E. Hendricks Company, 61 Beekman Street, New York.

BUILDING AND ENGINEERING TRADES DIRECTORY, containing complete and accurate lists, properly classified and indexed, of contractors and builders, also of manufacturers and dealers in all materials, apparatus, and appliances used in the construction, furnishing, and equipment of modern buildings and engineering projects, and all others identified with these interests in Boston and vicinity. Supplemented by the official lists of the building exchanges of Boston, together with the architects and engineers of New England. Price, $2.00. F. W. Dodge, publisher, Boston, Mass.

CHANGE OF FIRM NAME.

THE TIFFANY PRESSED BRICK COMPANY, Chicago, who are extensive manufacturers of a high-grade enameled brick, have changed the style of their firm name to the Tiffany Enameled Brick Company.

Mr. James L. Rankine, formerly president of the Pennsylvania Enameled Brick Company, having severed his connection with that firm, will manage the interests of the Tiffany Company in the East. Mr. Rankine's headquarters will be at Room 626 156 Fifth Avenue, New York City.

AFTER ELECTION NEWS.

MEEKER & CARTER have secured the contract for the terra-cotta in the new hall at Vassar College, York & Sawyer, architects; D. C. Weeks, builder. The color is light gray.

THE schoolhouse to be built in Roxbury district, Boston, will be built of Gartcraig Scotch bricks, those furnished by Waldo Bros. for other city buildings having been so satisfactory.

MEEKER & CARTER have the contract for the bricks to be used in the St. Francis de Sales Church, Brooklyn, R. L. Daus, architect; John T. Woodruff, builder. The bricks will be of an old gold shade and about 500,000 will be used.

THE TIFFANY ENAMELED BRICK COMPANY will furnish their enameled brick in the following new buildings. The Zoological Building, Pittsburg, Penn., J. L. Silsbee, architect. Women's Gymnasium, Ann Arbor, Mich. (Michigan University), Jno. Scott & Co., architects. Onondaga County Savings Bank Building, Syracuse, N. Y., R. W. Gibson, architect. City morgue, Cleveland, O.

THE PERTH AMBOY TERRA-COTTA COMPANY has closed the following new contracts for architectural terra-cotta. Park Row Building, Nos. 13–21 Park Row, New York City, R. H. Robertson, architect. York Hall for Omicron Association, New Haven, Conn., Grotvenor Atterbury, architect.

O. W. PETERSON & Co., Hancock Building, Boston, New England agents for the Standard Terra-Cotta Company, have secured the terra-cotta contract for the Taylor Building, Worcester, Mass., Fuller & Delano, architects; Thos. Barrett, contractor. Building is of light brick and terra-cotta.

THE NEW YORK AND NEW JERSEY FIRE-PROOFING COMPANY shipped last month about 4,200 tons of fire-proofing, and has booked a number of very large orders, which will keep them busy for some months. The demand for first-class fire-proofing material made of burned clay is greatly on the increase, and as the election is now settled, there is every prospect that business will continue to improve. A large number of new schools are to be erected in New York, provided the new issue of bonds to be sold by the city are successfully floated. Fire-proof structures can now be erected so cheaply that the number of them is greatly increasing.

CHAMBERS BROS. COMPANY, Philadelphia, are supplying a new outfit of machinery for rebuilding the works of the McAvoy Vitrified Brick Company, located near Philadelphia, and recently destroyed by fire. The new machine house, as well as the drying tunnels, will be built entirely of brick, with metal roof. The grinding machinery will be in a room partitioned off from the main machinery building. In equipping this new plant they will double their former grinding capacity, and put in a machine capable of making from 60,000 to 70,000 paving brick per day. They are also making some additions to their kiln capacity. The work is being pushed as rapidly as possible, as they have some important contracts on hand.

THE AMERICAN ENAMELED BRICK AND TILE COMPANY, New York, has recently completed a most satisfactory job at the new building for the Old Men's Home at Brooklyn, Johnson & Company, architects. In this building their patented interlocking tile was used to the exclusion of the full-sized enameled brick. These tiles will be used for wainscoting in the new building for the fire department at Jersey City. The same company will supply their enameled bricks for the new building of the Title Guaranty & Trust Company at Brooklyn, H. Anthony, architect, also for the completion of some work on the estate of Mr. Vanderbilt at Hyde Park on the Hudson, Norcross Brothers, builders.

The second quality enameled brick made by this company find a ready sale because of their general excellence. Fifty thousand of these bricks will be used in the St. John's Home Building at Brooklyn. The city of New York has used many of these bricks for lining cesspools and sewers.

Mount Savage Enameled Brick Company.

MOUNT SAVAGE, MD., is a small town nestling in a picturesque valley at the foot of Savage Mountain, one of the Alleghanies. The recollections of the oldest of its two thousand inhabitants are of historical interest, as it was here that the first solid railroad rail was rolled in the United States. The old rolling mill has disappeared long ago, but the ruins of the blast furnaces are still to the fore, a relic of bygone days.

Passing through the town is the Cumberland and Pennsylvania Railroad, which connects with the Baltimore and Ohio and the Pennsylvania Railroads at Cumberland, seven miles distant. This railroad runs through the coal fields of this well-known region.

The chief industry of Mount Savage is the manufacture of all descriptions of refractory goods from the fire-clay confined to this section of the country. This celebrated clay is justly recognized as one of the leading fire-clays of the world, and was discovered in the year 1840, fire-brick being manufactured the following year.

From the small beginning then made the business has increased year by year, until now the works cover fifteen acres of ground with a yearly capacity of 20,000,000 fire-bricks alone.

So well known are these bricks for their property of resisting high and continued heat, that they are shipped south to Mexico, north to Nova Scotia and Canada, and west to San Francisco and Montana.

MOUNT SAVAGE BRICK WORKS, MOUNT SAVAGE, MD.

The clay used is dark gray in color, having the appearance to the uninitiated of a hard rock; hard it is, but on the exposure of it to the action of the weather for a few months, it crumbles to a powder, which, on the mixture of water in the mixing pans, becomes exceedingly plastic.

In all chemical and empirical tests made by the government, it is passed as the highest grade, and is declared standard, all other clays being judged according to the relation they bear to it.

The superiority of this clay has long been acknowledged by those engaged in the trade, having enjoyed for half a century the highest reputation, and drawing to Mount Savage all our leading geologists, and others interested in the formation.

As the works have been going continually for the past fifty-five years, the men presently employed have stepped into the places previously occupied by their fathers, and, as it were, been born to it, are most expert in their different occupations, thus insuring excellence and uniformity in the product.

But Mount Savage is yet to achieve further honors in the manipulation of her clay, as a new branch has been added, the manufacture of enameled brick.

How this came about was through the pluck and perseverance of a young Scotchman, Mr. A. Ramsay, who landed in New York in January, 1895. Having been engaged in exporting these and similar goods to this side, and aware of the growing demand, he came to the conclusion that, from what he had read and heard of the resources of the United States, enameled brick could be manufactured here of equal quality to the English and Scotch makes.

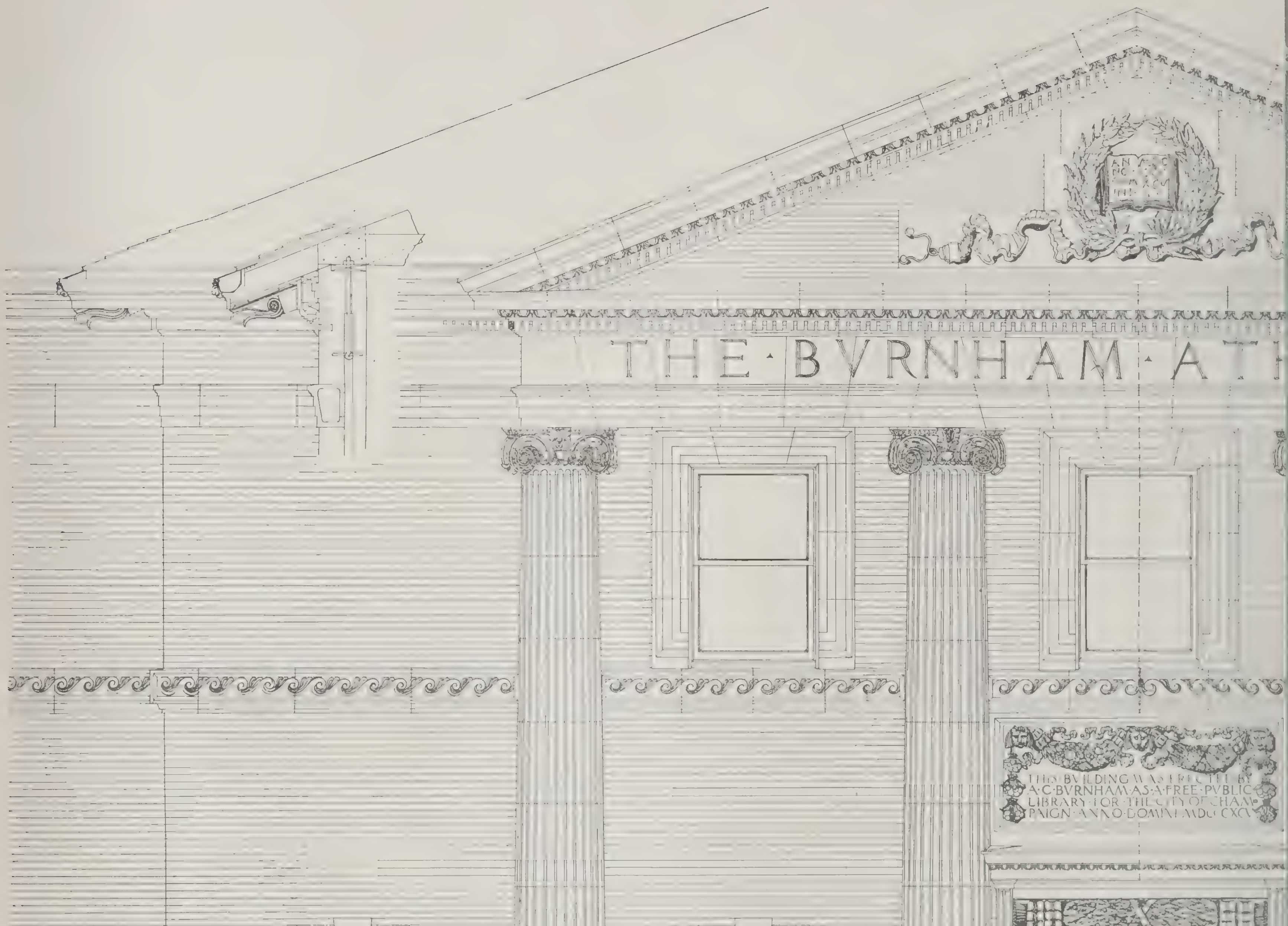
Shortly after landing he settled down in Trenton, N. J., and there passed several months testing and experimenting with the clays of New Jersey, but with poor results; he next tried the clays of Pennsylvania and Ohio, but these were equally discouraging. The New Jersey and Ohio clays are altogether different from that used in England for making enameled brick, as the clay is there found along with the coal measures, sometimes as deep down in the ground as 100 to 150 fathoms. The clay from the Pennsylvania coal fields, which Mr. Ramsay tested, was of inferior quality also, being deficient in fire-resisting qualities, and having excessive shrinkage, which is detrimental to high-class work.

He next turned his attention to the clay of Mount Savage, and saw at once he had found what he was looking for. In a short time he removed to Mount Savage to make further experiments, building a trial kiln in which to burn the ware. The first kiln turned out proved that his judgment was correct, and with the second he had a brick which compared favorably with the best.

With these results he had no trouble in interesting such capitalists as Warren Delano, Jr., of New York City, president of the Mill Creek Coal Company, Bee-Hive Coke Oven By-Products Company, director Union Mining Company, and also connected with other varied interests in the States of New Jersey, Pennsylvania, and Maryland; the Hon. John Sheridan, of Black, Sheridan & Wilson Coal Company, president of the New York Mining Company, a director Union Mining Company, Potomac Coal Company, Barton & Georges Creek Coal Company, government director of the Union Pacific Railroad Company, and one of our foremost mining men; Hugh A. McMullen, a well-known young business man of Cumberland, who, eminently successful in his own business, at once saw the importance of this new branch, and entered into it with his customary zeal. James Findlay, who succeeded his father as manager of the Mount Savage clay mines, and who has been engaged all his life mining and shipping the clay, also joined in, with the result that, in November, 1895, the Mount Savage Enameled Brick Company was formed

ENAMELED BRICK PLANT AT MOUNT SAVAGE.

VOL. 5. NO. 11.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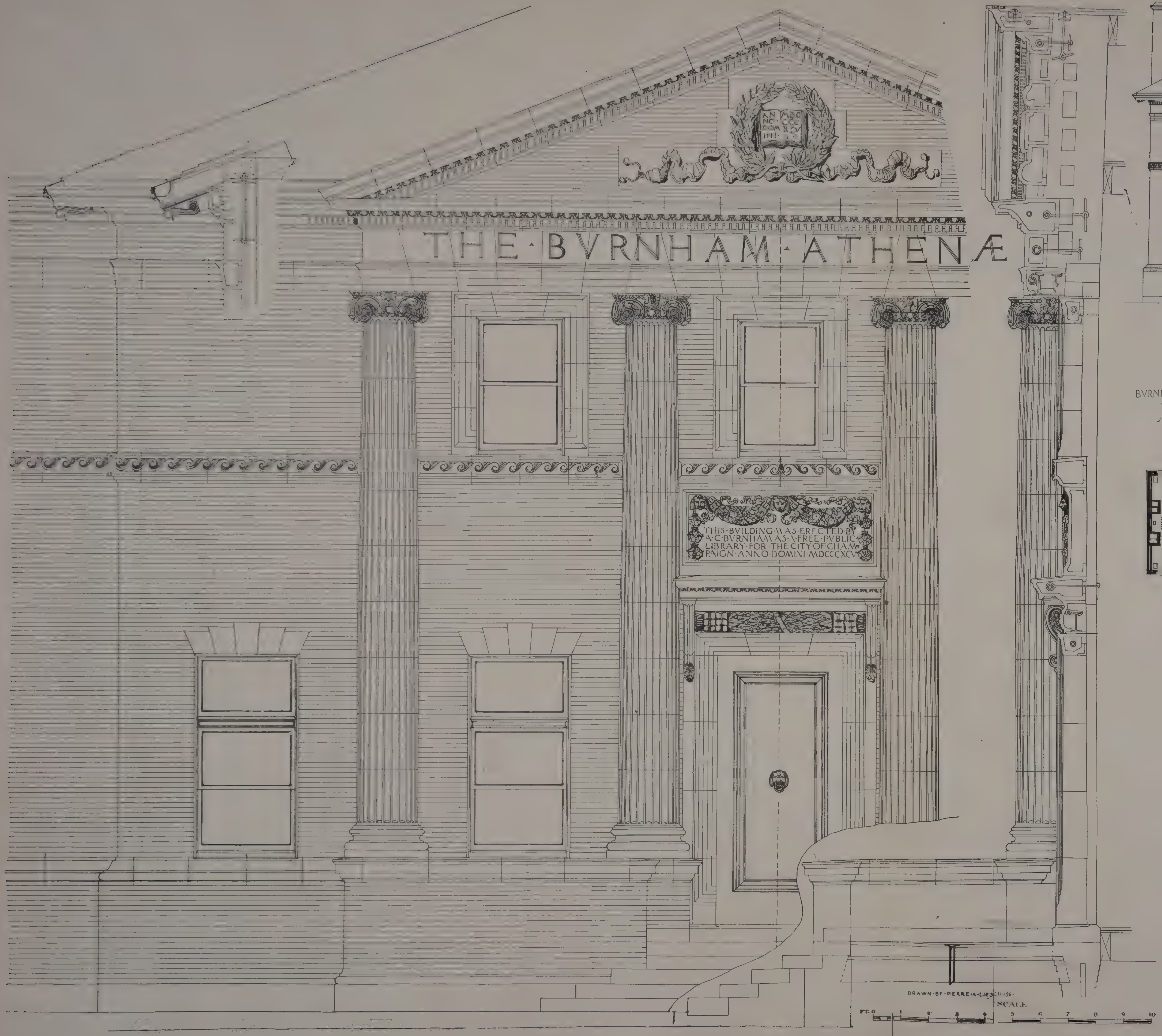
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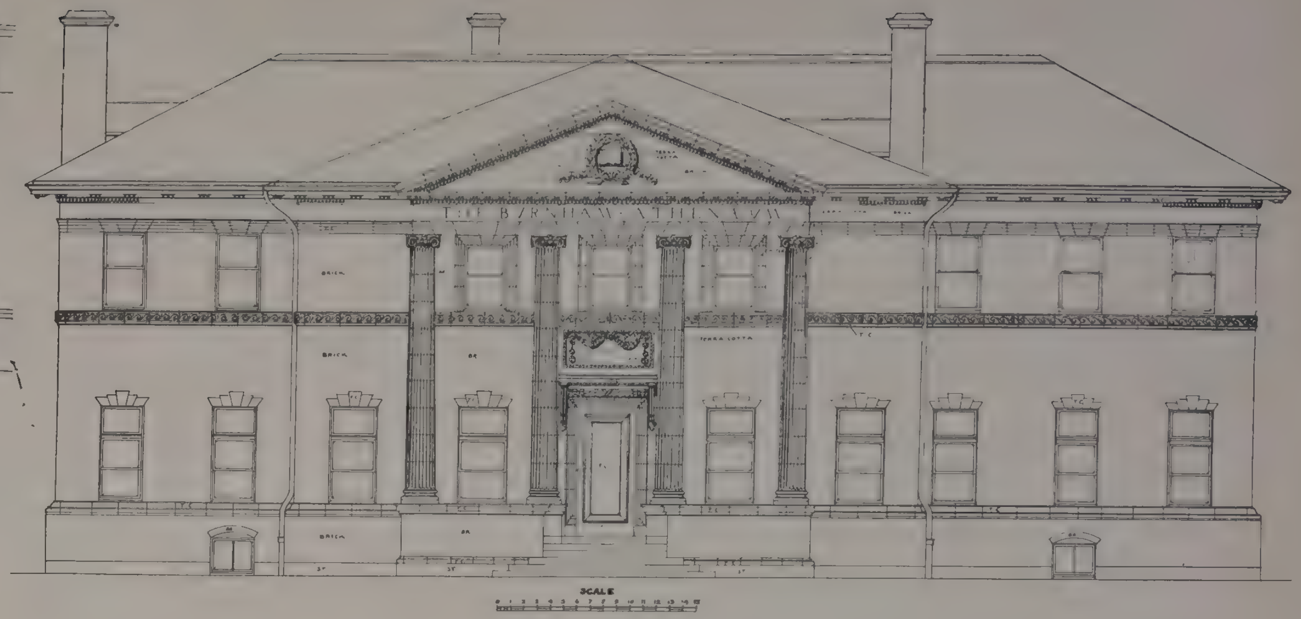

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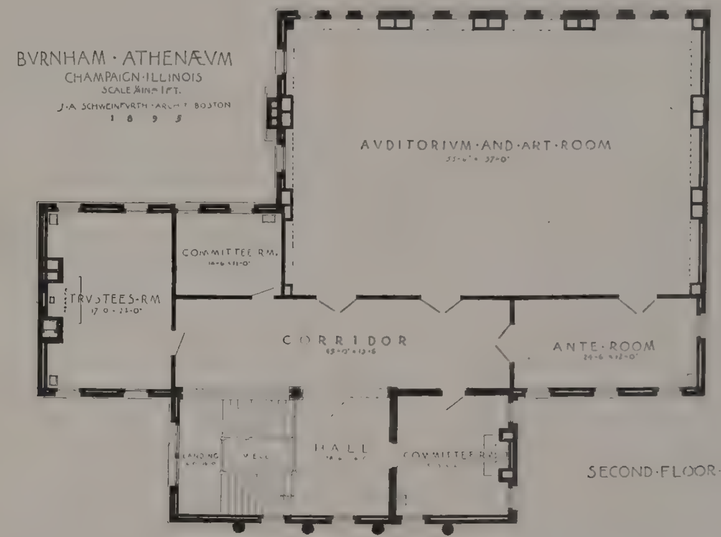
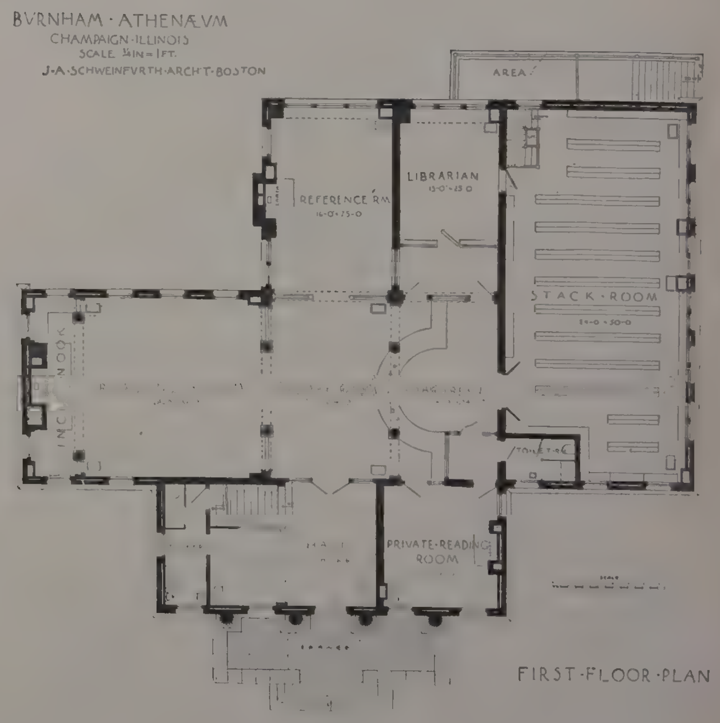


SECOND · FLOOR · PLAN



FIRST · FLOOR · PLAN

THE BURNHAM ATHENÆUM, CHAMPAIGN, ILL.

J. A. SCHWEINFURTH, Architect.

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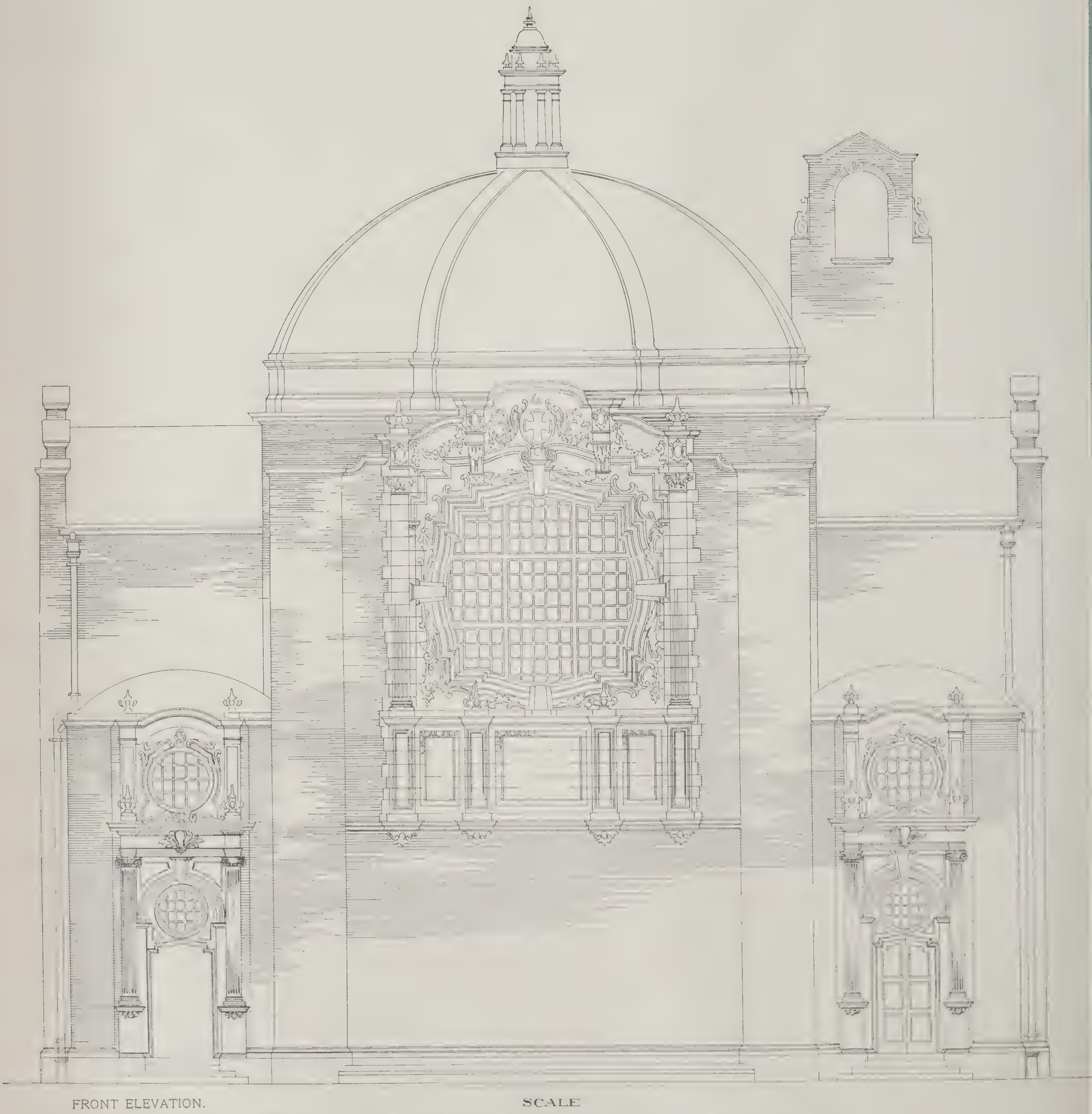
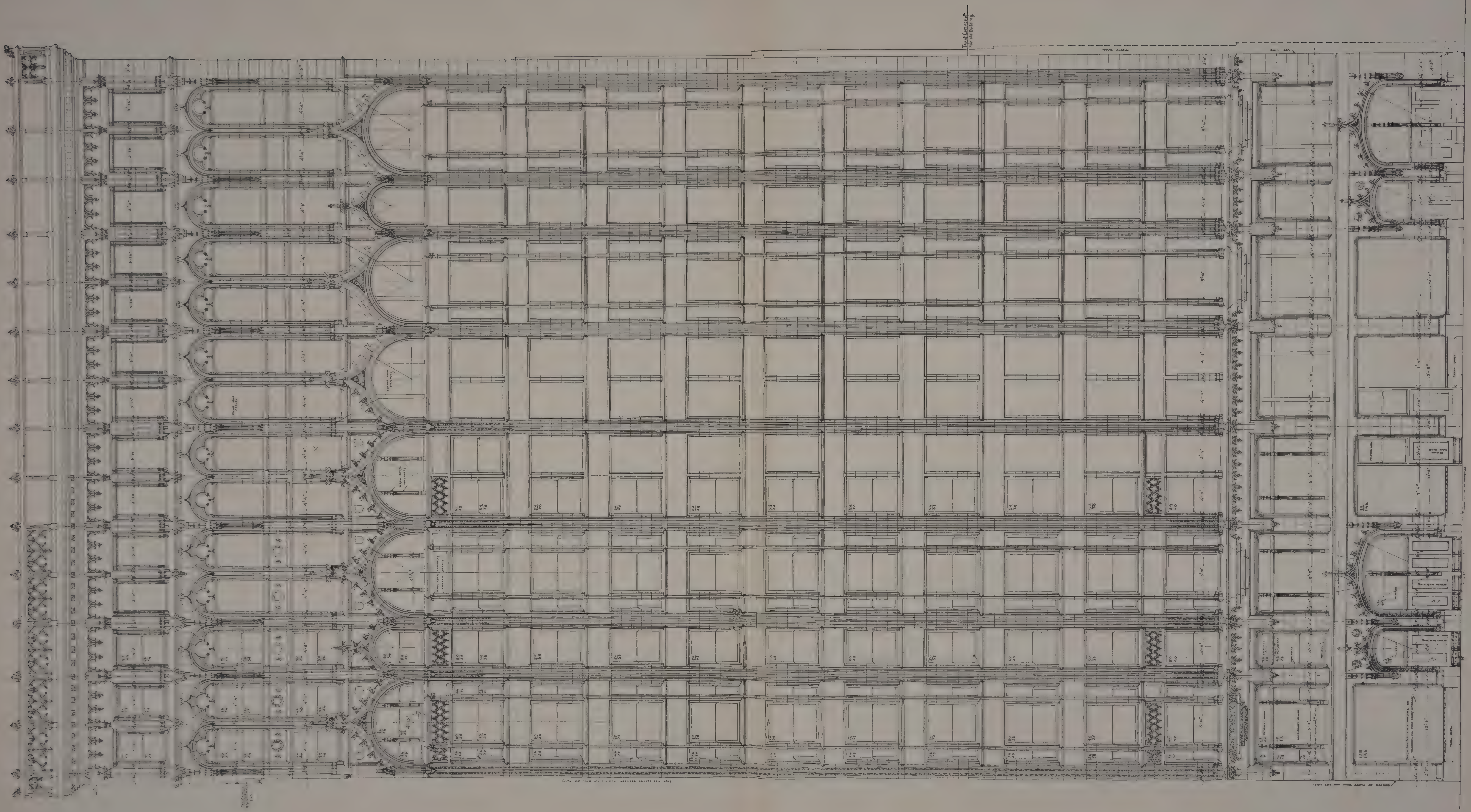


FRONT ELEVATION.

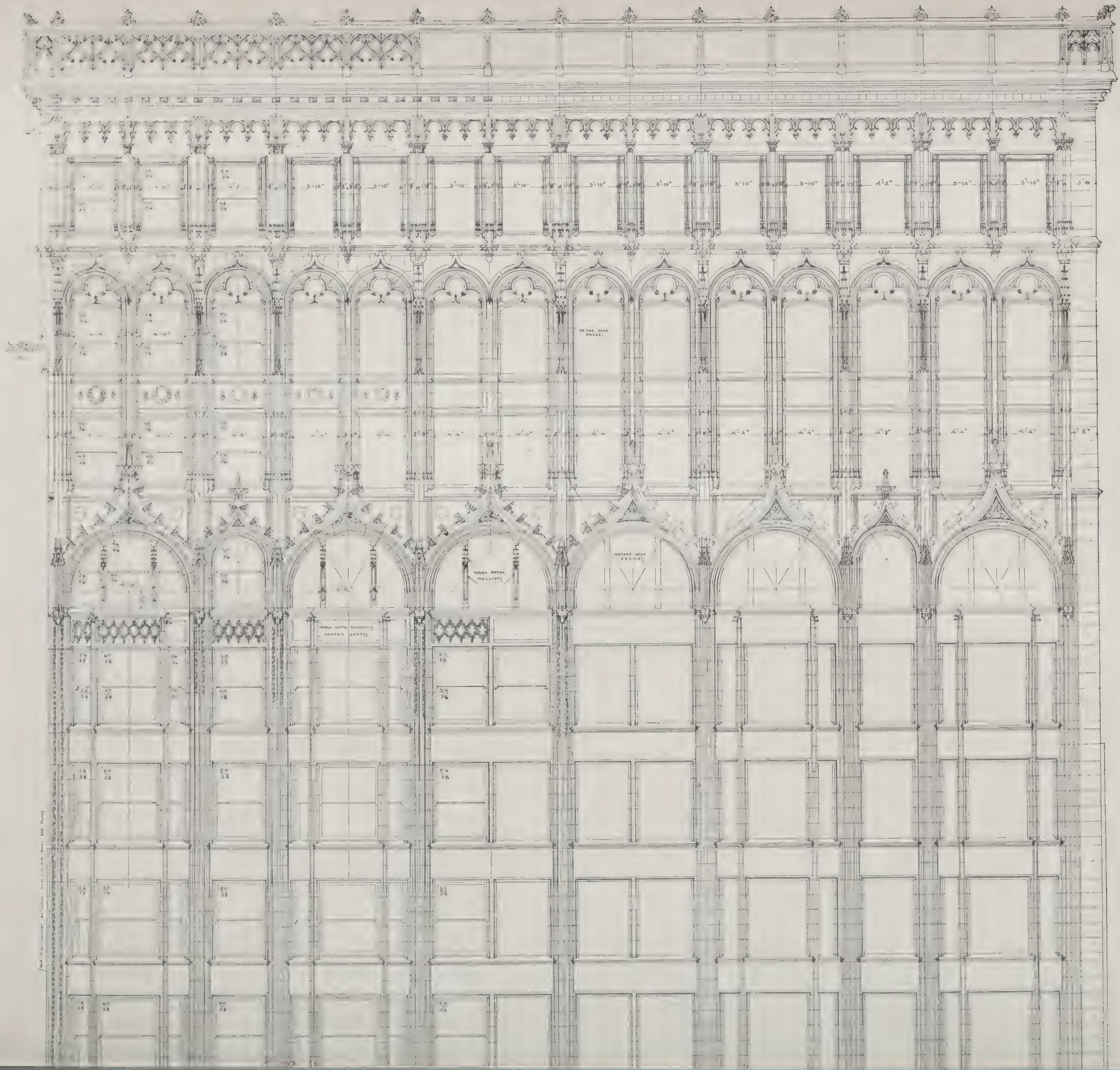
NEWTON METHODIST EPISCO

CRAM, WENTWORTH

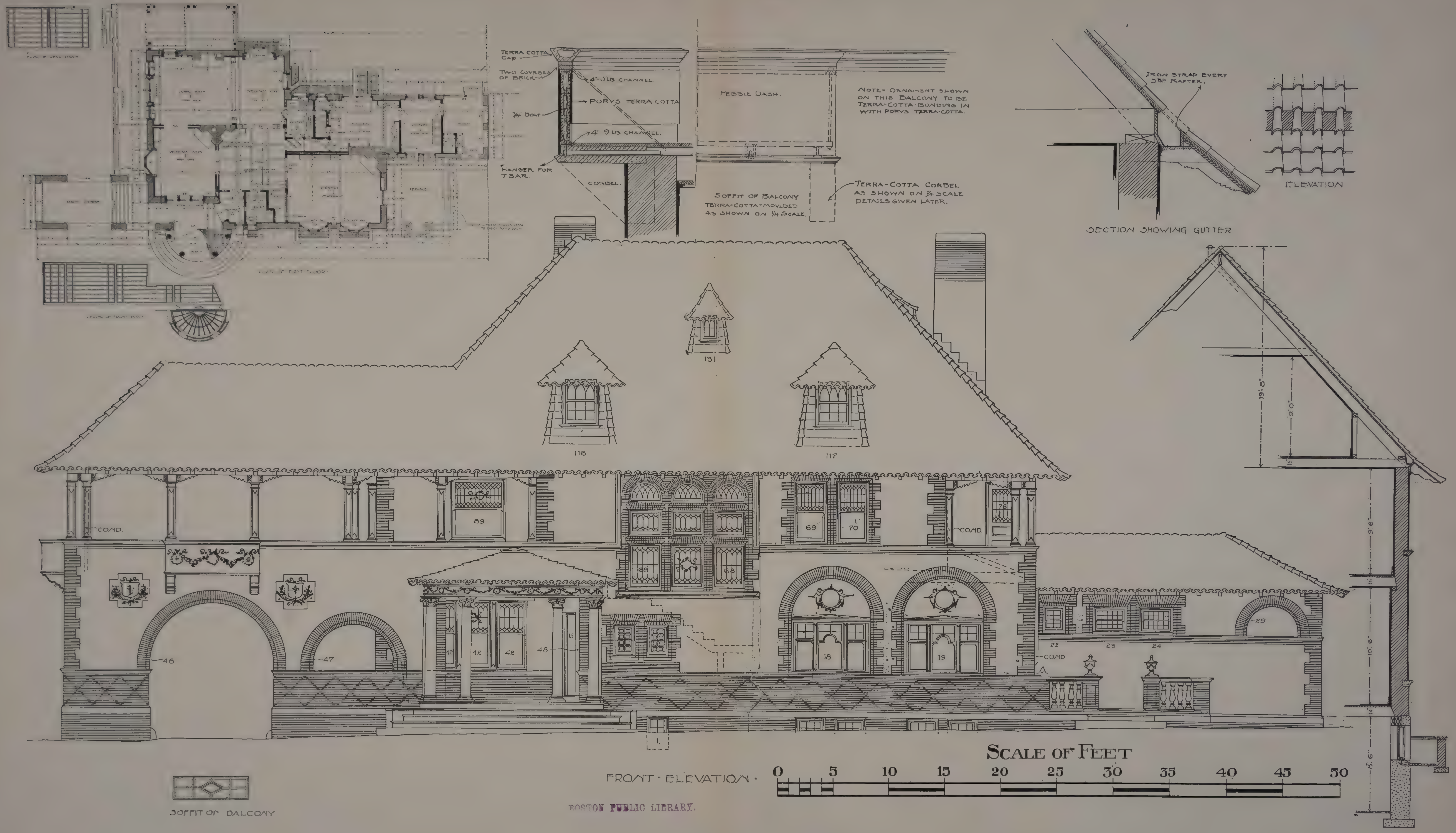


GREAT NORTHERN HOTEL, CHICAGO.—JACKSON STREET ELEVATION.

D. H. BURNHAM & CO., ARCHITECTS.


SQUARE HEAD FRAMES
TERRA COTTA MULLIONS
SQUARE HEAD FRAMES
TERRA COTTA GARGOYLES
COPPER SPOUTS

VOL. 5. NO. 12. PLATES 71 and 72.



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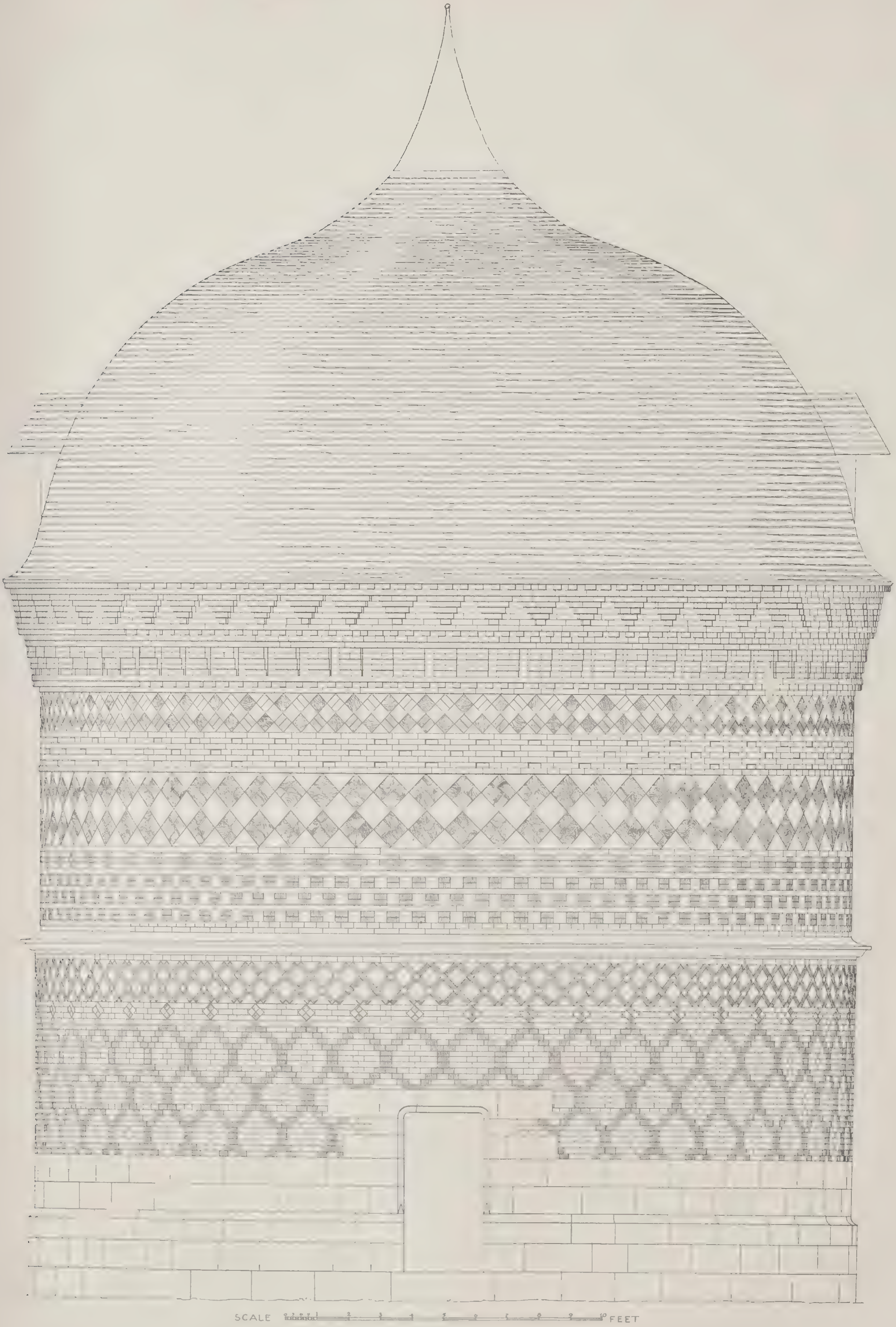
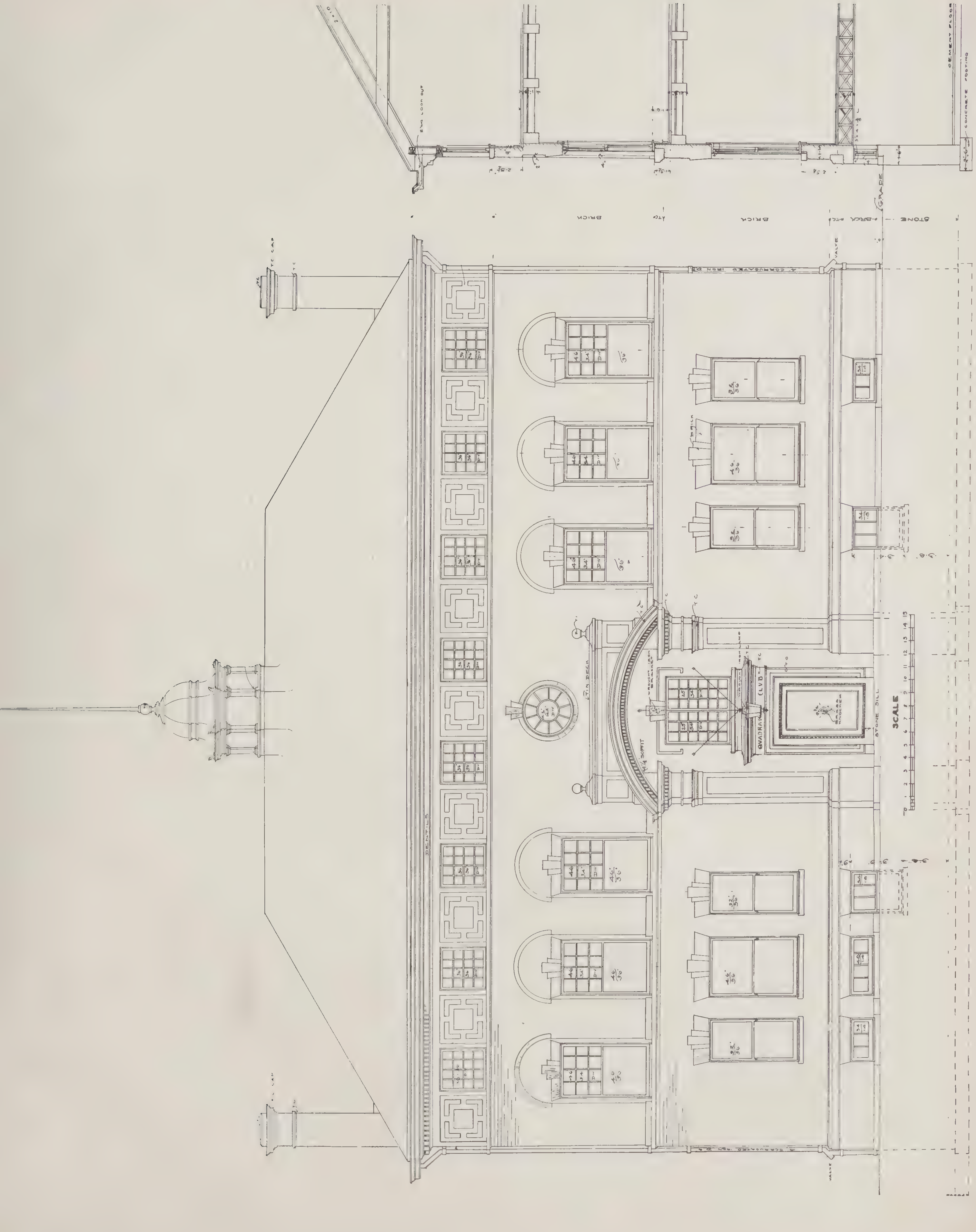
FRANK MILES DAY & BRO., Architects.



COLOMBIER D'ANGO, VERANGEVILLE, NEAR DIEPPE, FRANCE.

MEASURED AND DRAWN BY WILL S. ALDRICH (ROTCH SCHOLAR).



BUILDING FOR THE QUADRANGLE CLUB, CHICAGO. FRONT ELEVATION.

D. H. BURNHAM & CO., ARCHITECTS.

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THE BRICKBVILDER

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85
WATER
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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

The Brickbuilder Publishing Company,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3 50 per year

COPYRIGHT, 1893, BY THE BRICKBUILDER PUBLISHING COMPANY.

Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connection, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

PUBLISHERS' ANNOUNCEMENT.

ARTHUR D. ROGERS and Frank C. Manson, publishers of THE BRICKBUILDER, under the firm name of The Brickbuilder Publishing Co., will, after January 1, adopt the firm name of Rogers & Manson. This change in the firm name will in no way affect the management of THE BRICKBUILDER.

ARTHUR D. ROGERS,
FRANK C. MANSON,
Publishers.

L'ENVOI.

WE had occasion a short time since to investigate the construction of the old Brazer Building, which is now being torn down in this city to make room for a new eleven-story structure. This building was erected some sixty years ago, and has had the reputation of being thoroughly constructed and perfectly substantial, notwithstanding its lack of what are called modern conveniences and improvements; but it was found that the walls were laid up in such manner as to possess almost no cohesion, the bricks being in distinct courses, with so little binding that a slight motion of a crowbar would peel off, as it were, a large slice of wall. We cite this instance not so much to show that the particular structure was poorly built as to emphasize the necessity for avoiding such manner of construction in our modern work. It takes time to thoroughly bond a brick wall, and time has come to be accepted as so synonymous with money that some of our builders are apt to forget that in a case of this kind the rule would work by inversion, and that within reasonable limits the more time that was spent over thoroughly bonding a brick wall, the more value would be put into the structure. Most building laws allow a wall to be run up in separate vertical slices to a height of from seven to ten courses. If the vertical joints were thoroughly filled with a good quality of mortar, which they seldom are, or if the bonding course, when reached, were a thorough one, the resulting construction might be less open to criticism, but even in such case the strength of the wall would not compare with one which was thoroughly homogeneous. The use of steel skeleton construction has lessened, to a certain extent, the possible disastrous results of poor bonding in a brick wall, but such examples as the Brazer Building are apt to raise in one's mind a feeling of distrust of many of our older buildings, and they ought, at the same time, to increase the determination of the architect and of the builder to secure the results which depend simply upon good will and a little care on the part of the workmen, qualities which are so often lamentably and sometimes so vitally conspicuous by their absence or neglect.

SUCH instances as the one just referred to need not be interpreted as any evidence of general deterioration in the quality of work which is being put out in our large cities. A comparison with the good old forefathers' days, when work was done upon honor and day work was the rule rather than the exception, is often made, to the disadvantage of our modern structures, but we do not believe such invidious comparison is warranted by the facts. Brick and terra-cotta are to-day used in a far more intelligent manner, and, on the whole, with far more satisfactory results than were possible even with the best intent one or two generations ago. By a process of natural selection, of which THE BRICKBUILDER has claimed always to be the fair and impartial exponent, terra-cotta and brick have come within recent years to be, all things considered, the chief material of construction for large public buildings; and though there are exceptions, the rule holds that, on the whole, both these materials are used intelligently and successfully in both an artistic and practical sense. There have been in the past manifest practical objections to the use of brick and terra-cotta which we believe have been very largely overcome. It is only a few years since it was difficult to place contracts for terra-cotta with any assurety that the material would be delivered on time, and even if in those days we were so fortunate as to get the terra-cotta when we wanted it, it was more than even chances that the color would be uneven, or that the individual blocks would be so warped in the burning as to render it impossible to get a real workmanlike job in setting. We have changed all that, and there is now no difficulty in placing a large contract for brick or terra-cotta of specified kind, color, and amount, and having the order filled with perfect satisfaction. The special arts and industries which we have fostered in the past, and which are represented by the general policy of these pages, have assumed an importance both absolute and relative which is very gratifying to us and doubtless to our readers. The selection of brick and terra-cotta for so many of our public buildings has been due not to mere assiduous advertising or insistent pleadings, but has resulted from a natural growth which had unmistakably manifested itself, and which points to a permanence of choice. A talent for an art is rare. Only a few times in the whole world's history has the employment of any one material of construction risen to the height of a fine art. We may not be able to judge of the exact position which our burnt-clay industries will occupy when viewed in the dispassionate light of a hundred years hence, but we believe no one can study the results which have been achieved in the numerous brick and terra-cotta structures that have been erected in the cities of New York, Chicago, Philadelphia, and Boston without a conviction that we are working in the right direction, that our architects appreciate the limitations, the necessities, and the possibilities of this most plastic material.

THE prospective value of an art is always difficult to measure. We are so close to our own products that we sometimes fail to appreciate intrinsic qualities, and as the *Bourgeois gentilhomme* taught grammar all his days without knowing it, so it would be quite possible for us to be in the midst of an art-creative epoch, and be only vaguely conscious that we were fulfilling approximately our desires, and were commercially successful. It is doubtful if the works of Donatello or Michael Angelo appealed as strongly to them as they do to us, and the Della Robbias and Bernard Palissy had to fight their way to recognition while producing the choice treasures which we value so highly now. So, with our terra-cotta and brick industries of the present moment, that they are alive and full of vitality is manifest to the most casual observer. That terra-cotta has won a high position for itself and occupies a position which appeals to every architect as well as to the practical man of business cannot be denied. We would go even further. American architecture is in the formative state. Within the last decade the processes have changed so radically, the specialized manifestations have departed so widely from traditional canons, the necessities and demands made upon the craftsman have widened so enormously that architecture as a fine art is bound to be greatly influenced thereby, and whether or no we have reached the last word with terra-cotta, whether or no we have done all that might be accomplished with it, it cannot be questioned that the period through which we are now passing shows every sign of blossoming into an art-creative epoch which will fittingly mark the closing years of the century as a culmination of new ideas, new devices, and new applications. We believe that our best architects are designing terra-cotta correctly; that they are using it in a manner which our successors will stamp as being in accordance with good taste and the inspirations of practical genius; and it ought to be an encouragement to every one who loves art for art's sake, that it is possible now to accomplish such satisfactory results with such a minimum of expenditure of nervous energy and mechanical force. The problems which have confronted our architects of late years have forced them to turn to terra-cotta as the most natural and suitable exponent of their ideas. We are as yet following the lines of classic tradition. Our architecture still remains to a very considerable extent retrospective, but we are using the forms of classic antiquity and of the Renaissance not as ends, but as means. They are motives placed within the reach of our designers which can be utilized to the fullest extent to fit our actual necessities, and we believe that though this age is more often characterized as one of intense mechanical practical fact, it will go down to the future also as one in which the mental, the imaginative powers have had full play with new and untried problems, have grappled them and, on the whole, have solved them with consideration for the best aspects of modern art. In the Renaissance which the past two decades have witnessed, brick and terra-cotta have been the favorite medium through which we have been able to think our way to a truer art and a more perfectly allied construction.

BOOK REVIEW.

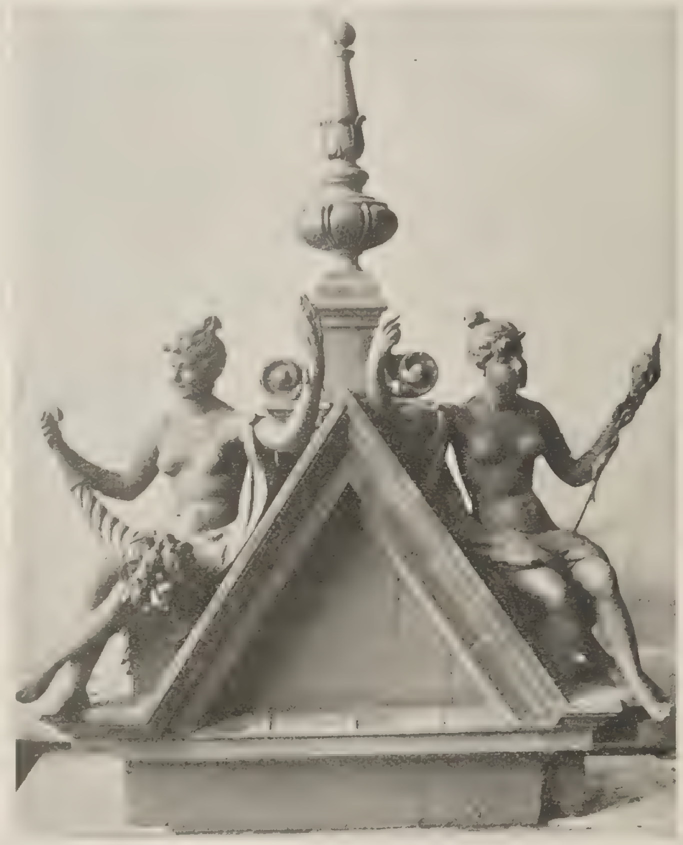
MR. RUSSELL STURGIS is a writer of such charming personality and is so keenly alive to the picturesque, romantic phase of architecture that it is a pleasure to welcome the addition made by him to the literature upon the subject of European Architecture. It is a guide for those who would study architecture by themselves, a help in the interpretation of photographs, and no one is better qualified than the author to place documental reference within reach of the student. The difficulty is to teach the beginner an exact appreciation of historic styles. This has been accomplished in a very presentable shape from the artistic standpoint. Mr. Sturgis thoroughly appreciates the needs of the student, and he very truly says that in the study of any fine art gain in the power of distinguishing the better from the less good is accompanied by a still increasing power of enjoying the best, and that it is better to sit at home with a plan and twenty photographs, with a sense of what that architecture truly means, than it is, without that sense, to visit all the cathedrals in France. The author has an evident fondness for the free spirit of the Gothic and the Romanesque and is loath to approve the existing retrospective practise of architectural design, but his presentation of the whole subject is perfectly fair, and his account of the architecture of the Greeks and Romans, is on the whole, the best, the clearest, and most easily comprehended statement of the wonderful art which these two peoples evolved that we can recall at this moment. The portions relating to these topics are specially valuable.

"European Architecture." An Historical Study by Russell Sturgis, A. M., Ph. D., F. A. I. A. New York: The Macmillan Company. London: Macmillan & Co., Ltd. 1896. Price, $4.

ILLUSTRATED ADVERTISEMENT.

THE adjoining illustration shows the apex of one of the dormers from the new Astor Hotel, now in course of erection on Fifth Avenue and 34th Street, New York City. The photograph was taken from a 1½ in. scale sketch model after it had been approved by the architect, Mr. H. J. Hardenbergh.

It will be noticed that the body of both figures is slightly elongated to allow for shortening, as they are destined to look down upon their blushing admirers from an altitude of 220 ft. above the sidewalk. The height of the actual figures will be about 8 ft.; the legs and arms being attached to the body by an interior iron anatomy of special construction. There are three of these dormers, and each of them will have a different subject, the present one being emblematic of agriculture and domestic industry. Mr. Louis Roncoli is now engaged upon the full-size models in the studio of the New York Architectural Terra-Cotta Company.



SOCIETY AND CLUB NEWS.

Mr. D'Aukmar Alder delivered a lecture before the Chicago Architectural Club, Monday evening, November 30, on "The Influence of Steel Construction and Plate Glass upon Style."

Monday evening, December 21, the club was entertained with lantern slide views, followed by a general discussion on Tuscany.

At a meeting of the St. Louis Architectural Club, held on the evening of December 5, Mr. W. B. Ittner finished the reading of the proposed new City Building Ordinance, which was afterwards discussed by the members of the club. At the same meeting Mr. Brenggeman gave an interesting talk on school and class work in the club.

At the annual meeting of the New Jersey Society of Architects, held at Newark, the following list of officers was elected for the year: President, Albert Beyer; First Vice-President, Robert C. Dixon; Second Vice-President, Paul Botticher; Secretary and Treasurer, George W. Von Arx; Trustees, Charles P. Baldwin, Thomas Cressey, Benjamin F. Hurd, F. F. Martinez, and Charles F. Zachan. There were six new names proposed for membership at this meeting.

At the last meeting of the Detroit Architectural Sketch Club, Mr. John Chase, of Boston, was a guest of the club, and gave a short address and a criticism of the sketch problems of the previous meeting of the club. At the second regular meeting, Mr. Alexander Trowbridge criticized the Summer Sketches, and supplemented his remarks with many points of interest to those studying color work.

The club has added a modeling class to the Saturday afternoon work, and the large attendance at all of the classes vouches for the interest taken by the club members.

The first competition given by the Detroit Chapter A. I. A., and open only to club members, is now in the hands of the club, and the drawings must be handed in before the twenty-first day of December, 1896. The program calls for a gate lodge and arch entrance to the new Palmer Park, located at the end of Hamilton Boulevard. The cost of the structure is limited to $25,000. The prizes are, first, gold medal; second, silver medal; third, honorable mention.

At a special meeting of the Executive Committee of the T Square Club, held at the office of the President, Mr. David Knickerbacker Boyd, the following resolution was adopted: —

Whereas, The public-spirited citizens of the State of California have determined to erect a series of new buildings for the University of California upon an unexcelled site overlooking the Golden Gate and the city of San Francisco, and

Whereas, The Regents of the aforesaid University are now receiving suggestions from various members of the architectural profession, and from many architectural societies, in regard to the best method of framing the conditions for competition to secure plans for their proposed buildings,

Be It Resolved, That the Executive Committee of the T Square Club of Philadelphia, the foremost architectural organization of Pennsylvania, recommend,

First, That the competition be restricted to architects of recognized ability of the United States, as, by so doing, we believe that more successful results will be obtained, inasmuch as they are familiar with the exigencies of American civilization, education, and climate.

Second, That a small committee of the representative architects be invited to confer with the Regents of the University of California, visit the proposed site, and prepare the program for the competition.

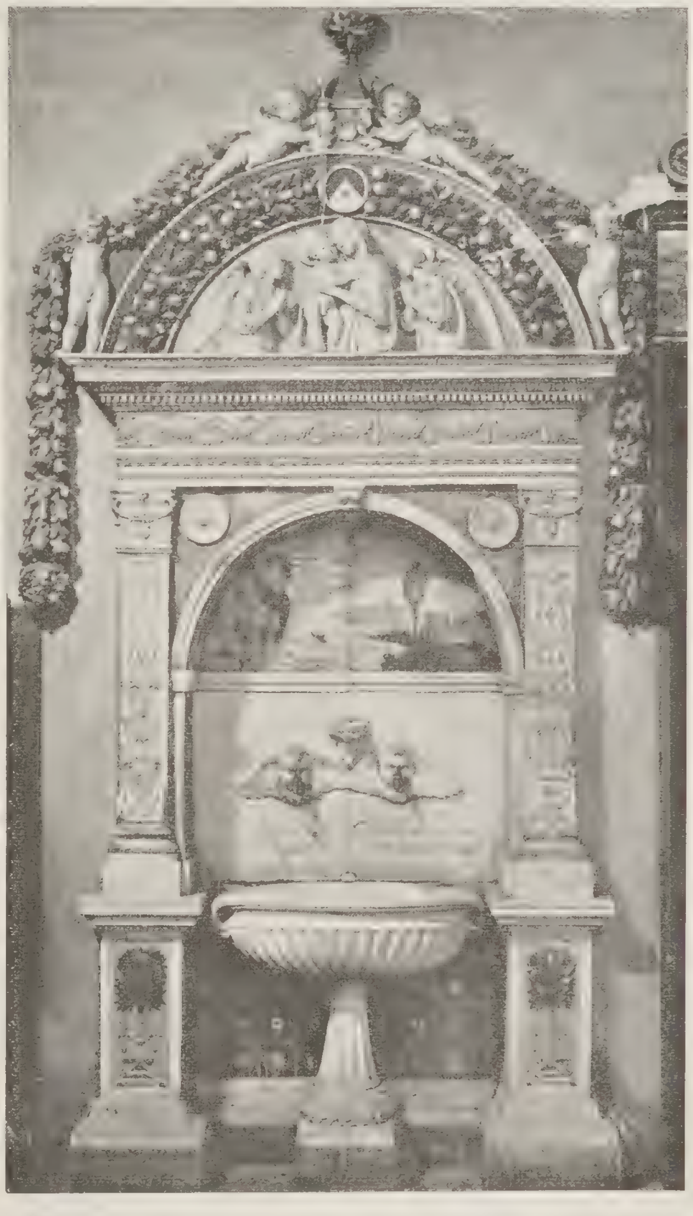
Third, That this same committee of architects be empowered to invite a certain number of additional members of the profession to enter with them into a paid competition.

And Finally, We believe that a restricted, paid competition will elicit more carefully studied designs and a stronger representation of leading architects than any form of open competition.

The Sons of Andrea Della Robbia.

BY ALLAN MARQUAND.

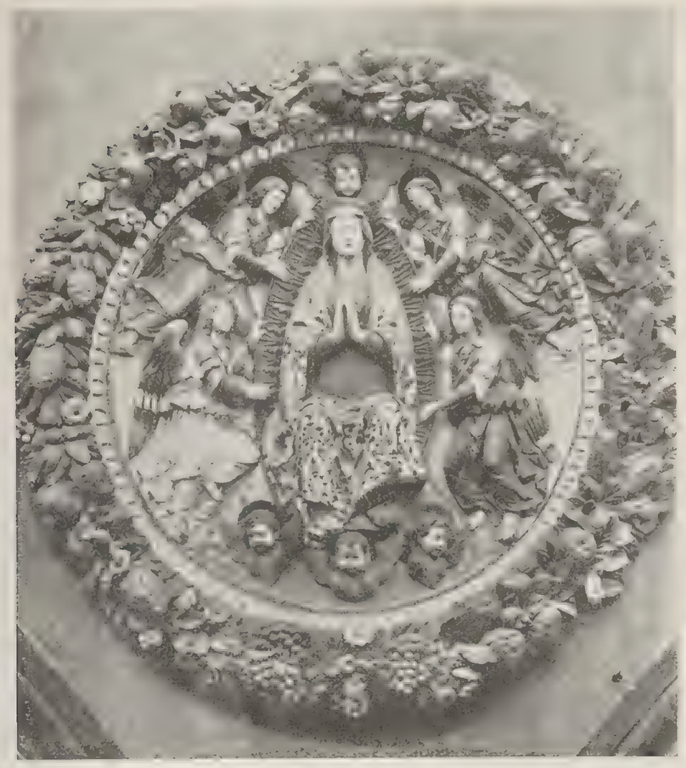
The success attained by Luca della Robbia and his nephew Andrea in glazed terra-cotta sculpture ensured at least for another generation the perpetuation of this artistic industry. Seldom has a father's trade been followed by so many sons. The older genealogies of the Della Robbia family tell us of seven sons of Andrea. Of these, Marco, Giovanni, Paolo, Luca, and Givolamo are put down as sculptors, and as if the list were not already sufficiently long, modern investigation has added another, known as Fra Mattia. The religious influence of Savonarola captured three of Andrea's sons, who became monks in the Dominican order. The eldest, Marco, changed his name to Fra Luca; Paolo assumed the name Fra Ambrogio; and one of the others became Fra Mattia. This did not altogether destroy their practise of the art of sculpture, although it may have proved a serious check.



FONT IN THE SACRISTY OF S. MARIA NOVELLA, FLORENCE.
BY GIOVANNI DELLA ROBBIA.

Fra Luca (born 1468), is not known to us by a single work. Fra Ambrogio (born 1470), is known only by a spiritless "Nativity" in the church of San Spirito at Sienna. This is a group of statues of barbarous style, entirely lacking in the charm which characterized even the minor productions of most Florentine sculptors. Fra Mattia was, in all probability, a more prolific sculptor. The one authentic work by which he is known is an elaborate altar-piece at Monte Cassiano, near Macerata, in the Marches.

Pretentious altar pieces, with frames overcrowded with diminutive figures, abound in the smaller towns of the Marches. It is only occasionally that a monument like the Annunciation in the church of Santa Maria del Soccorso, at Arcevia, which I believe to be his, tells us what Fra Mattia could accomplish, when free to do his best. Less accomplished than his father, he seems to have been a more refined sculptor than any of his brothers.



ASSUMPTION OF THE VIRGIN, CEPPO HOSPITAL, PISTOJA.
BY GIOVANNI DELLA ROBBIA.

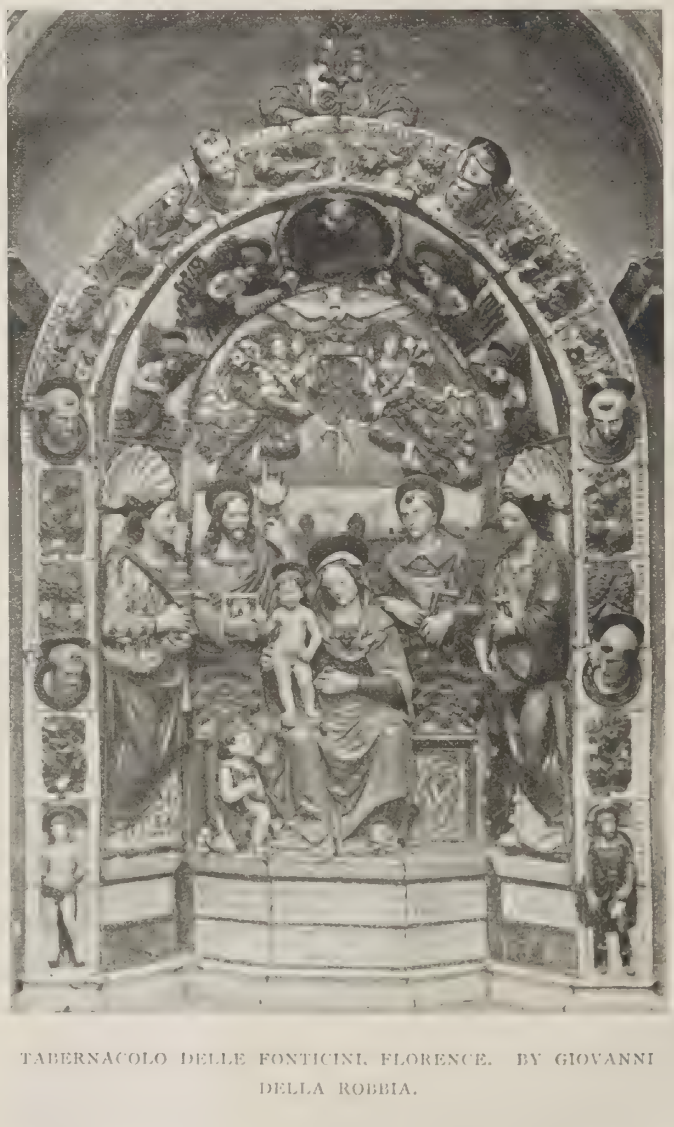
Luca, the son of Andrea, was born in 1475, and is known to have executed, after the designs of Raphael, pavements for the Loggie of the Vatican as well as the armorial bearings of the pope. Such of these tiles as still remain, and the coats of arms in the Industrial Museum, at Rome, show Luca to have been an excellent artisan when inspired by Raphael. That he was a very mediocre sculptor may be seen from a signed "Madonna" preserved in the Vatican.

Givolamo della Robbia (born 1488) is known chiefly as a decorator, especially of the Château de Madrid, at Paris, now destroyed. Our knowledge of Givolamo's work is necessarily very fragmentary. His style can hardly be determined from the few broken tiles still preserved in the garden of a restaurant near the site of the château.

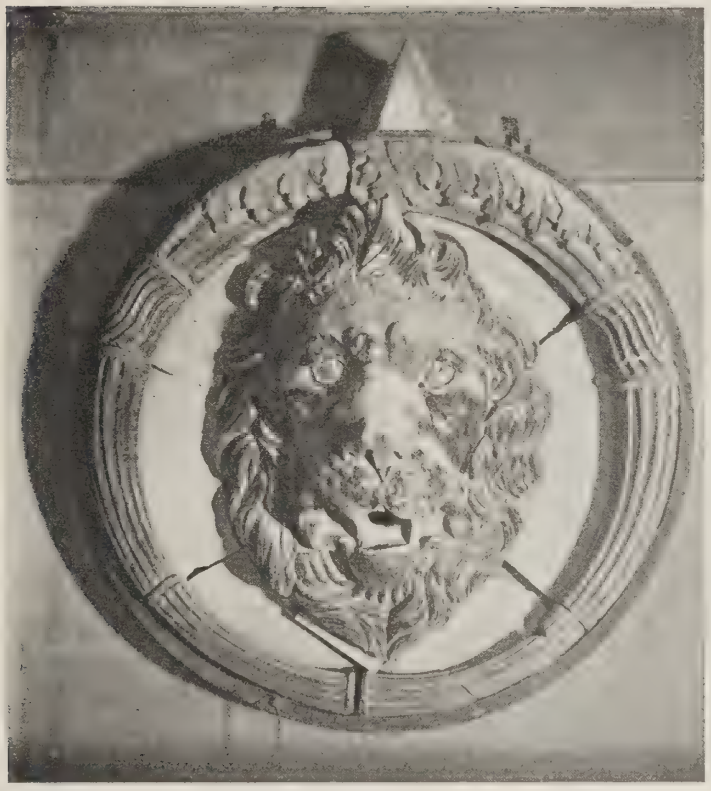
The best known of all the sons of Andrea is Giovanni (1469–1529?). His works have a character of their own, not difficult to recognize when once we have become acquainted with a few well-authenticated examples. As he sometimes signed and frequently dated his works, it is easy to follow the progress, or rather the decadence, of his art. His earliest work bears a strong impress of his father's influence, as we may see from the sacristy font at S. Maria Novella (1497). All that is best in this font may be traced directly to the inspiration of Andrea della Robbia. But even here we may detect careless workmanship, inferiority of style, and a mixture of pictorial with sculptural design.

That Giovanni was influenced by the painters even more than by the sculptors of the time may be seen from his baptismal font at Galatrona (1510). A replica of this font exists at S. Piero a Lieve, and a third polychromatic example of it at Cerreto Guidi. Richness of effect seems to have been his ideal, and as we follow his career the struggle for such effect is almost desperate. The lover of sculpture will not linger long before Giovanni's altar-piece of the "Assumption of the Virgin" now in the Campo Santo at Pisa (1520), but he may well halt awhile in the Via Nazionale, in Florence, to see the "Tabernacolo delle Fonticini" (1522). Here Giovanni may be seen at his best. Judged by the standards of the elder Luca and of Andrea, we may pronounce this work poor in composition, bad in modeling, and atrocious in color, but it seems to us, nevertheless, the best that Giovanni could do, and we wish the monument might be removed from the dusty glass closet in which it stands and transferred to the National Museum.

Perhaps the most celebrated of all the works of the Robbia school is the frieze of the Ceppo hospital at Pistoja. From one end of Italy to the other the lover of Robbia ware is apt to meet the question, Have you seen the frieze at Pistoja? This frieze, the authorship of which is still a puzzle to historians of art, has been attributed to almost every member of the Robbia school. It is now known, per documentary evidence, that Giovanni della Robbia, Benedetto Buglioni, and Santi Buglioni were concerned in its production. Just how much Giovanni had to do with it may be judged from the evidence furnished by the work itself. The circular medallions below the frieze are his; the frieze itself is by other hands. One can hardly mistake Giovanni's angels and virgins, his peculiar crudities of modeling and coloring, his monotonous garlands of fruit and



TABERNACOLO DELLE FONTICINI, FLORENCE. BY GIOVANNI DELLA ROBBIA.



LION AND RING OF LEO X. BY LUCA DI ANDREA DELLA ROBBIA.

flowers. All the peculiarities of his style are found in the medallions, but the frieze exhibits new modes of composition, more vigorous and life-like figures, and a new scheme of coloring.

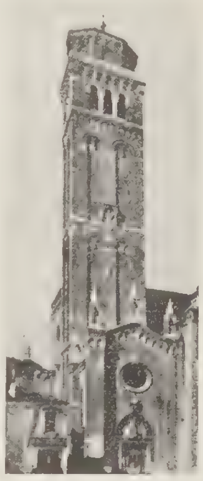
THE STORY OF THE ROOFING TILE.

ROOFING tiles were originally made, like bricks, of baked clay. According to Pausanias, Byzes of Naxos first introduced tiles of marble about the year 620 B. C. Besides the superior beauty and durability of the material these tiles could be made of a much larger size than those of clay. Consequently, when they were employed in the construction of the greatest temples, such as that of Jupiter at Olympia, the Parthenon at Athens, and the Serapeium at Puteoli, their dimensions were in exact proportion to the other parts of the building, and the effect of the parallel rows of joint-tiles descending from the ridge to the eaves, and terminated by ornamental frontons, with which the lions' heads over the cornice alternated, was exceedingly grand and beautiful. How highly this invention was prized by the ancients is proved by the attempt of the Roman censor Q. Fulvius Flaccus to despoil the temple of the Lacinian Juno of some of its marble tiles, in order to adorn another temple which he had vowed to erect in Rome. A still more expensive and magnificent method of roofing consisted in the use of tiles made of bronze and gilt.

Tiles were originally made perfectly flat, or with nothing more than the hook or nozzle underneath the upper border, which fulfilled the purpose of fixing them upon the rafters. They were afterwards formed with a raised border on each side. In order that the lower edge of any tile might overlap the upper edge of that which came next below it, its two sides were made to converge downwards. It was evidently necessary to cover the lines of junction between the rows of flat tiles, and this was done by the use of semicylindrical tiles called *imbrices.* The roof also, by the exact adaptation of the broad *tegulæ* and the narrow *imbrices* throughout its whole extent, became like one solid and compact framework. The rows of joint-tiles divided the roof into an equal number of channels, down which the water descended into the gutter (*canalis*) to be discharged through openings made in the lions' heads. The rows of flat tiles terminated in a variously ornamented front, which rose immediately above the cornice.— *The British Brickbuilder.*

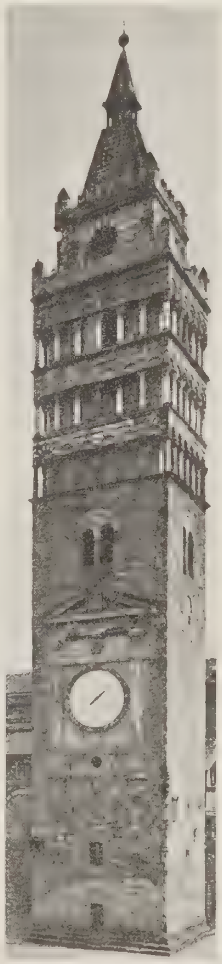
Italian Towers. III.

BY C. HOWARD WALKER.



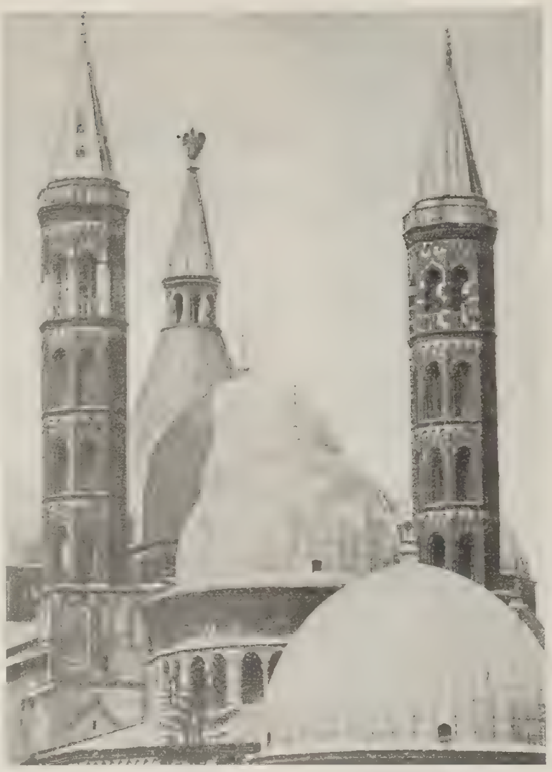
TOWER CHURCH OF THE FRARI, VENICE.

COLONNADES and arcades are prevalent in Italian architecture of the twelfth and thirteenth centuries. It seems evident that the row of columns separating the nave from the aisles in the interiors of the basilicas, which was a poorly constructive feature of the plan, established a motive which later forsakes the interior of the churches to appear again upon their façades and around all exterior constructed masses. The sequence of idea seems to have been as follows. The great buildings of the Romans were designed at an enormous scale; the arches of brick veneered with marbles were of huge span, those of the Basilica of Constantine being respectively 87 and 97 ft. The arch became the customary method of spanning openings, and the most impressive feature of architecture. It was used with great skill, and the workmanship was of the best. But with the decline of the Empire came naturally the decline of craftsmanship, and the builders of the early Lombard churches in the North and of the basilicas in Rome were less capable than their predecessors. To emulate the work of the earlier builders, however, not only appeared the most obvious thing, but fitted best with their desires. It was natural that an arcaded treatment should seem to them the height of architectural expression, and if they were incapable of building great arches, they at least could build a great number of arches. If the presence of large stones, or the skill to cut them was lacking, and consequently the span of openings could not be great, at least the number of openings could be increased, and multiplicity of parts in some measure compensate for diminution of scale. This, then, would account for the fact that in the twelfth and thirteenth centuries, in Italy, the usual motives upon the façades of buildings were those of colonnades and arcades, that they were superposed upon each other as in Santa Maria della Pieve, in Arezzo, that they follow the slope of the aisle roofs as in Lucca and Piacenza, that they coiled around the tower at Pisa, and beautified nave, aisle, cloister, portal, campanile, and lantern, as at Pavia. They were no longer necessitated by the conditions of construction, but had become an ornamental method of construction, and a very beautiful one. Whatever criticism may be made in regard to them, in that they appropriated surfaces and portions of the building which would have been more dignified as plain wall, they contrast so successfully with the masses of wall which remain, they possess such depths of shadow, such possibilities of the accidents of chiaroscuro, that they can well be forgiven the alleged faults of monotony and uncultivated expression.

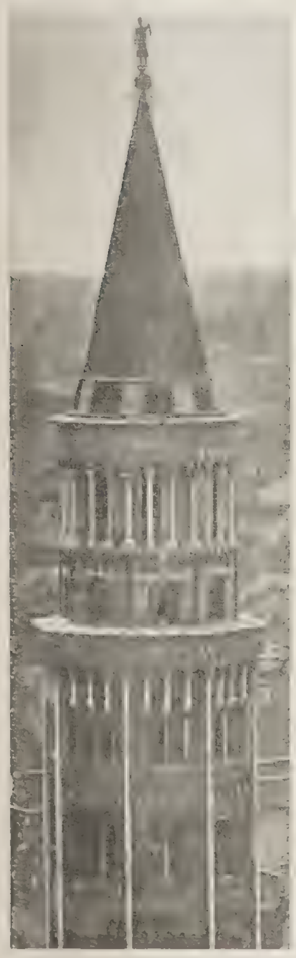


TOWER CATHEDRAL, AT PISTOJA.

It is to this class of campanile, that depend for their effect upon successive colonnades and arcades, that the present paper is devoted. During the thirteenth century a new type of tower makes its appearance — an octagonal upper portion upon a square base. This form is probably derived from the East during the period of the Crusades. It appears early in the lanterns or low domes of the Syrian churches, when octagons were supported on pendentives, is developed by Asiatic architects, and is a very usual form both in Asia Minor and along the North African coast. The idea of superposing one geometric solid upon another having once been adopted, many variations appear. Octagons upon octagons, and circular forms upon both octagons and squares. In most cases the lower stories of the tower have a square plan, then the octagon is used, and the circular plan in the upper stories, though occasionally the order is reversed, but with less satisfactory result. These towers have in most cases high conical roofs, occasionally low-pitched roofs. They are of both Lombard and Gothic characters.


TOWERS OF SAN ANTONIO, PADUA.

The towers of the cathedral at Pistoja and of the cathedral at Palermo are of the square form. That of the Church of the Frari, in Venice, has an octagon upon a square, and has a low roof. Those at Chiaravalle and of Cremona have two octagonal forms, one above the other, superposed upon a square, while the tower of San Gottardo, in Milan, and of San Antonio, in Padua, are octagonal, and the lantern at Pavia has superposed octagons. These towers were all built in the century from 1280 to 1380.

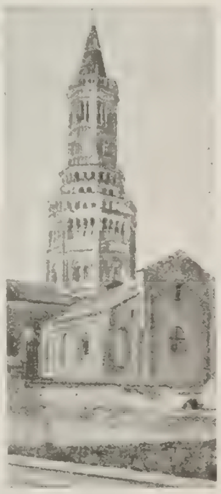

SAN GOTTARDO, MILAN.

The Pistoja tower is one of the finest in all Italy. It was built originally as a watch-tower for a fortification in the days when every city in Italy was at war with its neighbors. It then was undoubtedly of a similar type with the still-existing square fortification towers of Bologna and San Gimignano, and perhaps had a Ghibelline parapet, although, as Pistoja was the town where the division between Guelphs and Ghibellines first occurred. it is doubtful whether the parapet was square or forked. At this time it was connected with the Palazzo opposite by a bridge, and formed practically a citadel. The cathedral of which it now forms the campanile was built in 1160, and rebuilt by Nicolo Pisano in 1272, the tower in the latter end of the thirteenth century being rebuilt in its upper portion by Giovanni de Pisa, who added the arcades of colored marbles, and the high roof with its lantern. The old tower appears to have resembled that of La Mangia at Sienna, having square above square, and upon this substructure Giovanni applied his arcades.

The cathedral at Palermo was built by the English Archbishop Walter of the Mill (*Gualtiero offamilio*) in 1165, but the towers were built about 1350. They have a strange commingling of Saracenic and Norman detail, with the Italian campanile mass. The upper portions are probably fifty years later than the dates given, and have Gothic pinnacles.

The Church of the Frari, in Venice, was built from 1250 to 1280, but its campanile probably dates from 1350. In its severity and simplicity it resembles the earlier Roman towers, but has both Lombard and Gothic detail; the roof is low.

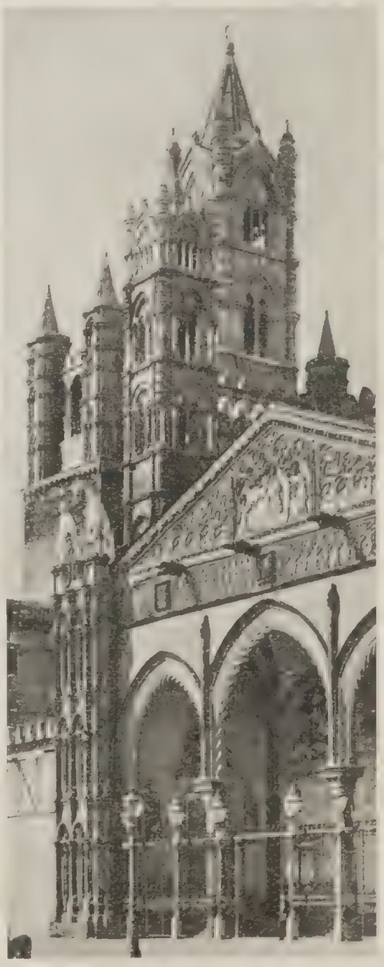
At Chiaravalle, near Milan, was founded the first Cistercian monastery in Italy, in 1134. The church was dedicated in 1221, and the lower portion of the beautiful tower at the junction of transepts and nave was completed at this time. The base of the tower is as broad as the nave. The upper portions, comprising the arcades about octagonal forms, already spoken of, are of later date, indications pointing to 1320 to 1340 as the probable date of the completion of the tower. It is not only unusual in its location as regards the church, but the tower is very individual in character and beautiful in its proportions.


TOWER OF CHURCH, AT CHIARAVALLE.

The tower of the cathedral of Cremona was begun in 1283 to commemorate peace between Cremona, Milan, Piacenza, and Brescia. It is an extraordinary tower, nearly 400 ft. in height, with windows variously grouped, and with detail of many successive periods, as the tower was not roofed until 1581.

The tower of San Gottardo, in Milan, is stated by Symonds to have been built by Azzo Visconti, in 1280, but it shows evidences of changes dating certainly a century later. It is one of the most beautiful of the Italian towers, delicate, exquisitely proportioned, and with fine contrasts of color.

The towers of San An-


TOWER CATHEDRAL, AT PALERMO.

tonio, of Padua, while graceful, are not especially well proportioned. The church is supposed to have been founded in 1357. These towers seem a quarter of a century later.

TOWER, THE CERTOZA, PAVIA.

The Certoza, at Pavia, a Carthusian monastery, erected by Gian Galeazzo Visconti in 1396, has a very beautiful octagonal arcaded lantern with a Renaissance termination.

OLD BRICKS.

I HAD occasion some time since to visit a recently constructed building in Cambridge in company with the builder, who called my attention to the quality of the bricks which had been used in the structure, explaining that, as he expressed it, any old brick answered for a job of that sort, that he had used the commonest brick he could find, and the architect was perfectly satisfied. I admitted that I appreciated the motive of the architect. The result was certainly interesting in every respect, the color being good, the wall surface sufficiently pronounced to have a distinct texture without being mottled or unduly variegated, and for the particular design the result was obtained in a legitimate way. The builder reasoned from this that the poorer the brick used, the better the architect is satisfied. This we often encounter in our intercourse with brick manufacturers, and a feeling is at times evinced that the architect does not appreciate the best efforts of the brickmaker, and that the energy and thought which have been expended in producing a thoroughly first-class face brick are wasted, from the maker's standpoint, as far as practical business results are concerned. That such a view is reasoning without a proper appreciation of the architect's motives was made manifest to me by comparison with another construction recently erected in this city, in which precisely the same effect was produced on the wall surface as in the Cambridge example, by the use of some of the very best face brick which the market affords. In the latter instance the color scheme, the wall texture, the freedom from undue formality, was accomplished just as in the Cambridge example, with the added excellence of a far superior article and a better constructed wall.—*Bostonian.*

TOWER, CATHEDRAL OF CREMONA.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

(*Continued.*)

THE introduction of terra-cotta for architectural purposes in America dates from about the year 1853, when it was used for the sills, pilasters, and pediments of windows, as well as for string and cornice courses in the Hotel St. Denis, Broadway and 11th Street, New York City. This building is still intact, and the terra-cotta shows no signs of wear; but of late years it has fallen a victim to the indiscriminating brush of the house painter, who has laid on his pigment so thickly as to leave people in doubt whether these features are brownstone or cast iron. Few imagine that they, and the tiger's head keystones overlooking Trinity Churchyard, represent the first terra-cotta made in New York, or, so far as is known, in America. The pioneer architect, in the one case, was the late James Renwick, then a young man fresh from his studies in Europe, and with the terra-cotta of Italy impressed upon his mind as a thing worthy of remembrance. The keystones, used about the same time on the Trinity Building by his most notable professional contemporary, the elder Upjohn, are free from the slightest semblance of decay; but they, too, have been smudged out of recognition by vandals whose conceptions of "the sublime and beautiful" find a common center in the paint-pot.

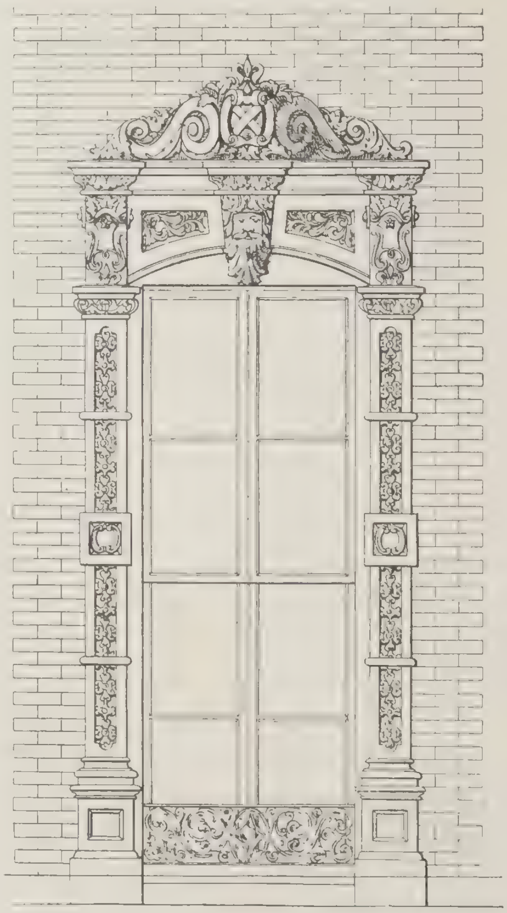
This formal introduction of terra-cotta did not set many new kilns on fire in or around New York. Though ordinarily quick to perceive and ready to patronize a thing of artistic or commercial value, her citizens were singularly slow in their acceptance of this one. Spasmodic attempts were made to revive it during the following twenty years, but at the end of that time its use had become a reminiscence in the building trade. Where it had not been utterly forgotten, it was relegated to the list of things that had failed irretrievably.

Meanwhile, Mr. J. B. Cornell stepped in to supply a generally acknowledged want, and one that was every day becoming more keenly felt. For a period of about twenty years he was energetically engaged in pushing his cast-iron columned and pilastered fronts, that reached — from his point of view — their highest development in the A. T. Stewart dry goods store, and later in the Park Avenue Hotel. The enterprising foundryman set up the fabric of the building, and his too willing allies, the house painters, did the rest of the decorations. The outcome of their united efforts belongs to a past era, but they have long since taken an abiding-place in the estimation of architects, as the acme of things that are Philistine and of forbidding aspect

Not until 1876 did terra-cotta show any sign of revival, and even then it was applied sparingly, with many apologies, in the face of dire forebodings, and not without some mental reservations on the part of its sponsors. It was about this time that Mr. Alfred Hall, of Perth Amboy, N. J., put aside the manufacture of kitchen crockery, and adapted a portion of his plant to the making of constructive and decorated building blocks. Whether this initiative was taken in order to supply a demand, or with an intention to create one, it would be difficult to say; most likely he had a vague hankering after both. In any case, it is safe to assume that the two influences acted and reacted reciprocally, and for the common good. This small beginning had its full share of the ups and downs incident to the creation of a new and exceedingly hazardous industry. After many vicissitudes it developed into the now extensive plant of the Perth-Amboy Terra-Cotta Company, in which the relatives of Mr. Hall are still largely interested.

The demand so created, and partially supplied, continued to increase, and after a lapse of ten years the field of operations had become sufficiently wide to admit of another large works being established. The premises of the New York Architectural Terra-Cotta Company were specially built, and located in close proximity to the center of what has since become, and is likely to remain, perhaps, the greatest of all markets for "architecture in materials of clay." The architects, no less than the building public of New York, have long since realized the extent of their neglected opportunities, and have already done much to atone for their earlier prejudices. What the end will be no man can foresee, but this much we know: the material which the builders rejected has now become generally used and deservedly respected. Whether it shall be all but universal in the twentieth century lies chiefly in the hands of those who are at present actively engaged in its manufacture.

It is surprising how many of nature's secrets have been unraveled in a quiet, practical way, merely by the experimental mixing of certain clays, the adding of other minerals, and the application of varying degrees of heat. Results hitherto deemed unattainable have, within a very few years, been reduced from the condition of a laboratory to that of a commercial product. But the possibilities are far from being exhausted. Much remains to be done before the process of terra-cotta making can be proclaimed an exact science. The greater accuracy of its architectural lines, and the surmounting of other mechanical difficulties, affords scope for the highest technical training. In these respects there is room for a nearer approach to an ideal standard. The certainty and promptitude of delivery have been brought within measurable distance from a given date. There was a time when the rate of progress on a building of any magnitude depended upon the uncertainties of terra-cotta. Now it is governed by the laborious manipulation of granite and the condition of trade at the rolling mills. But while much has been done, much yet remains. The production of an unimpeachable material should be the first consideration, on the part of those interested in its prospective success, and to this goal their efforts should be directed unitedly, and by mutual consent.


TERRA-COTTA WINDOW, HOTEL ST. DENIS, NEW YORK. WORK MADE 1853.

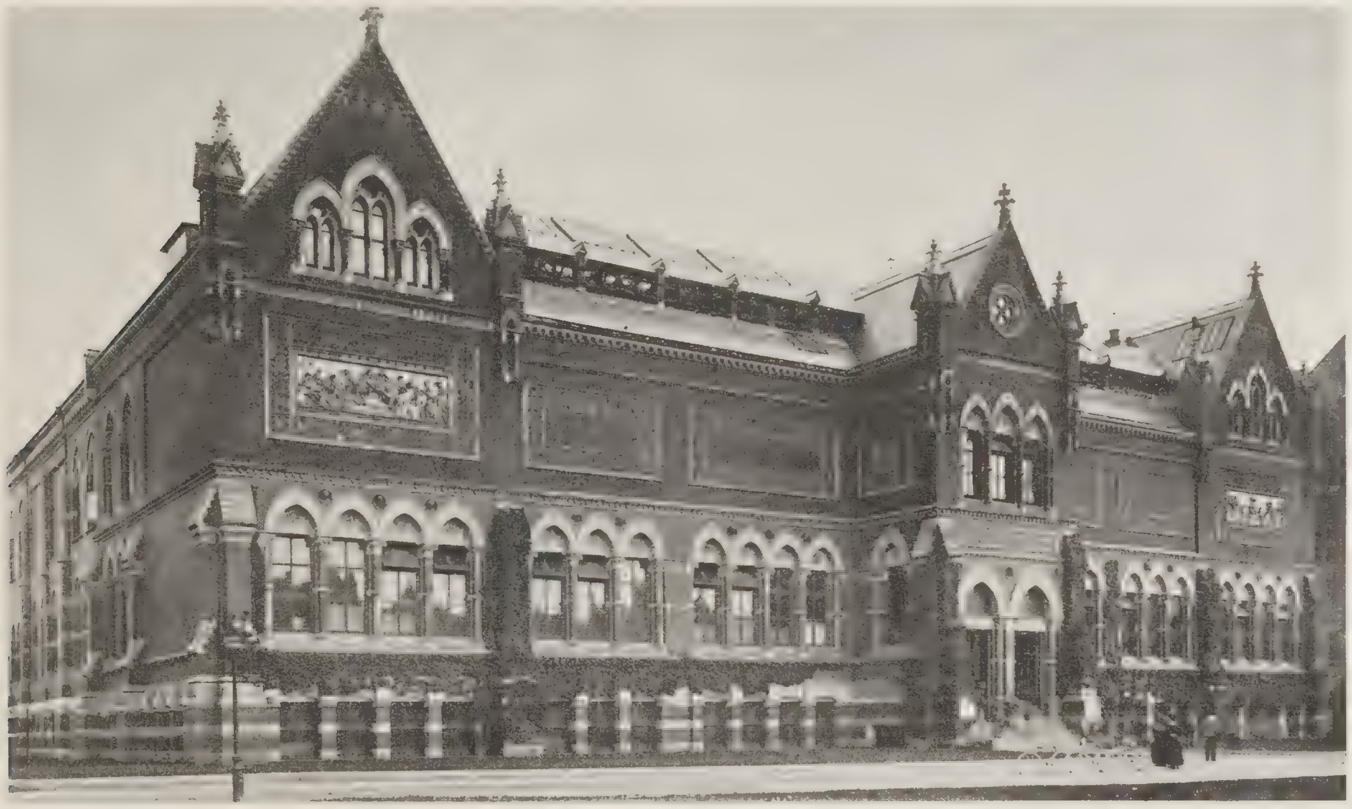
The Chicago fire of 1871, while it caused suffering and temporary loss, proved in the end a positive gain to that city. It swept away the plank sidewalks and mushroom exhalations of the prairie, and at the same time impressed the homeless but undaunted settlers with a keen sense of the need for more substantial habitations, constructed of less inflammable materials. This led to an immediate and general use of brick, with an accompanying demand for terra-cotta, in the form of sills, lintels, string-courses, and other elementary necessities required by people who could ill afford to spend time or money on a higher grade of embellishment. In a surprisingly short time brick and terra-cotta structures, most of them bearing evidences of haste, but more or less fire-proof, became the rule, as the modern city arose, phœnix-like, from the ashes of what had been merely a Western boom-town of the first magnitude. The demand has since continued to increase, each year's output being far in excess of the year before. The quality of the goods has likewise been improved artistically and mechanically, and the manufacturing facilities have been correspondingly extended. The crudities of design have long ago been laughed or frowned out of existence, by being contrasted with later and less hideous compositions.

And now, at the end of the first twenty-five years of a new, and certainly higher state of existence, this, the most modern of all cities, can point to examples of commercial architecture — chiefly in brick and terra-cotta that are famous to the confines of civilization. For this improved condition of things much credit is due the present Northwestern Terra-Cotta Company, which has lived to enjoy the reward of successful, persistent effort. Among her many architects of wide repute, Chicago has produced one that is preeminent. The prose of business requirements has yielded to the poetic touch of Louis H. Sullivan, at once an artist and an architect, whose courage and candor are in admirable keeping with his originality. Unlike many men of genius, he has had the good fortune of not having been born before his time, however well abreast of it he may now be. A very slight acquaintance with his work enables one to see, that in the waning years of the nineteenth, he has set the pace for those who would design the "soaring and lofty" things of the twentieth century.

That useful and deserving cow, that kicked the lamp that started the blaze, has a place in history along with the baker, in whose shop, in Pudding Lane, the fire of London started in 1666, that ended a week later at Pie Corner. It, too, was of great benefit; and but for the greed of private owners, and the unhealthy state of public feeling under Charles II., the heart of the great city would not now be suffering from congestion, consequent upon its narrow and tortuous, though still picturesque thoroughfares. The fire came as though by command of the Great Architect of the Universe, to purify the city from the plague of the preceding year. Incidentally, it gave Wren his eagerly accepted chance of immortality.

About 1872, the conservative citizens of Boston began to give serious attention to terra-cotta, and finally decided, though not without much opposition, to use it in preference to stone in the erection of their Museum of Fine Arts, an ambitious project then under consideration. In this resolve, it cannot be said that they were influenced by any desire to give an impetus to a local industry, for nothing of that kind had then reached the most infantile stage of development. As a matter of fact, the whole of this work was made in England and imported ready for setting in the building. But no one will suspect the people of Boston of any lack of patriotism on that account. No terra-cotta plant existed in the city, and though Chicago offered her services "for a consideration," it was declined with the thanks due to a praiseworthy apprentice effort. She herself was at that time groping her way out of darkness, under the dubious guidance of perambulating quacks, some of whom were then, and have since proved themselves, blind leaders of the blind. Messrs. Sturgis & Brigham, however, had convinced themselves of the enduring qualities of the material, when made by men of experience and integrity; and the trustees of the then recently founded institution relying upon their judgment, sustained the senior member of that firm when he set out in quest of it. It was conceded that a start had to be made somewhere, and if neither Boston nor any other city in the Union was equal to the occasion, there was no great harm in drawing once more from the prolific mother of Anglo-Saxon literature, industrial arts, and manufacturing enterprises. The contract was given to Mr. Blashfield, of Stamford, Lincolnshire, a man who enjoyed a deservedly high reputation among English architects as one of the few really capable terra-cotta makers of his time.

His work on the Museum of Arts is very good, considering the early period at which it was made, but we could now mention half a dozen flourishing firms in the United States whose average output is quite as good. Any one of them could, upon occasion, duplicate this imported example with work of superior texture, and of a higher



BOSTON MUSEUM OF FINE ARTS. STURGIS & BRIGHAM, ARCHITECTS.

grade in point of durability. But to it belongs the credit due to a pioneer effort; executed in doubt as to the effect of our trying climate, and under difficulties that have, ere this, ceased to exist. It did something to attract favorable notice, and for several years was regarded as an object lesson, alike by architects and by those who, soon afterwards, undertook the manufacture of terra-cotta in Boston. Some of the window mullions have of late shown signs of crushing, which may be due to unequal settlement in the building, a want of proper filling-in of the chambers, or to insufficient burning.

The method in vogue at that time, but long since abandoned, of rubbing down irregularities with coarse sandpaper, when the work was white-hard, and just previous to burning, has much to answer for. It disturbed the plastic surface that had formed on the face of the block, in obedience to the laws of molecular cohesion, leaving such parts tender and porous. It was a mistaken way of making ends meet; for no degree of firing could ever force the minute particles of clay to reassemble and associate together as before. It is a significant fact that every indication of fracture or decay is found on blocks that have been sandpapered before burning. A similar expedient, emanating from the same source, was introduced in this country, and with like results. Instances of it may still be seen on work of the New York Produce Exchange, but as its originators ceased to be controlling factors in the business, this and many other wrong-headed practises were reversed, or allowed to die a natural death.

The Boston Museum of Arts is a rather handsome building, the prevailing color being a light red, relieved with buff, and now softened by creeping vines around and between the buttress weatherings. The style leans in the direction of Italian Gothic, with a suspicion of Romanesque imparted to it by the spiral and lozenged shafts and window mullions. It has two sculptured panels emblematic of "The Genus of Art" and "Art and Industry," but these are inadequate. The remaining spaces, filled (temporarily, we hope) with a monotonous diaper of extreme modesty, afford unusual opportunities for the display of native talent, such as this and similar institutions have assisted to develop during the past twenty years. The building itself was the forerunner of other and better examples of terra-cotta architecture, bearing evidences of taste and progress; all tending to the advancement of plastic art, of a decorative, yet essentially architectural character. It faces the square named after Copley the painter, father of an English lord chancellor, with an uninterrupted view from Boylston Street. On one side is Trinity Church, around which the memory of Phillips Brooks will linger for years to come. It is the masterpiece of Henry Hobson Richardson, perhaps the greatest of American architects, a man whose genius was the mainspring of his individuality. He died too soon, having all but succeeded, during a brief period of ten years, in evolving a style of architecture that his country might have claimed her own, and had her claim allowed. On the other side of Copley Square stands the magnificent public library, the work of a well-known firm of American architects. In the immediate neighborhood there are enough art, literary, and educational institutions to make this the Latin quarter of Boston. What more fitting place than these blank spaces in the walls of the Museum of Arts, for a worthy and enduring embodiment of the art themes so tunefully idealized by Longfellow? The work of the modeler is already more than half done, being outlined in relief on the printed page by the vivid imagination of the poet. Aided by such inspiration, a true artist could not fail to infuse life into his subject, and perchance some of "the fascination and the nameless charm that shall lead all men captive." Has he not sung the praises of Palissy and Della Robbia, and the clay workers of every age and clime, in rhapsodies as sweet as ever fell from the strings of Æolian harp?

"This potter, working with such cheer,
In this mean house, this mean attire,
His manly features bronzed with fire,
Whose figulines and rustic wares
Scarce find him bread from day to day?
This madman, as the people say,
Who breaks his tables and his chairs
To feed his furnace fires, nor cares
Who goes unfed if they are fed,
Nor who may live if they are dead?
This alchemist with hollow cheeks
And sunken, searching eyes, who seeks,
By mingled earths and ores combined
With potency of fire, to find
Some new enamel, hard and bright,
His dream, his passion, his delight?"

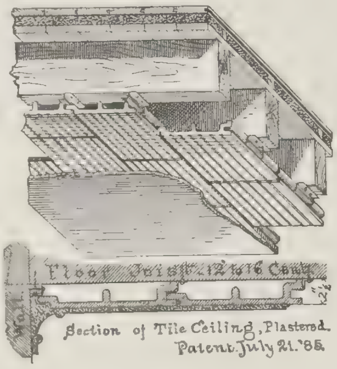
"O pleasant Tuscan town,
Seated beside the Arno's stream;
For Lucca della Robbia there
Created forms so wondrous fair,
They made thy sovereignty supreme.
These choristers with lips of stone,
Whose music is not heard, but seen,
Still chant, as from the organ screen,
Their Maker's praise; nor these alone,
But the more fragile forms of clay,
Hardly less beautiful than they,
These saints and angels that adorn
The walls of hospitals, and tell
The story of good deeds so well
That poverty seems less forlorn,
And life more like a holiday."

Fire-proofing Department.

SOME EXPERIENCES OF MODERN FIRE-PROOFING MATERIAL IN ACTUAL TESTS. (*Concluded.*)

BY PETER B. WIGHT.

THERE have been two actual tests of ceilings made of hard fire-clay tiles, one of which resulted in the total destruction of all but the exterior walls of the building; and in the other case, with an equally severe fire, the building was saved with a loss of goods on one floor only, and a damage by water to the two floors below it. In each case the same tiles and the same construction were used, though in the former the joists were 2 ins. thick, placed 16 ins. from centers (altogether too light), and in the latter they were 3 ins. thick and placed 12 ins. from centers. In the former building there had been two previous fires, that had been subdued, but when the third and last fire occurred, the building, which had been designed for offices, was rented out on several floors to job printers, and not only had heavy printing-presses been introduced, but considerable areas of the tiles in the ceilings had been removed for the setting of shafting, and had not been replaced. The form and construction of these tile ceilings are shown in detail in the illustration. The tiles were 9 by 16 ins. and only ½ in. thick in every part, but were stiffened by the groove at one edge, the tongue at the other, and the rib in the center. They were machine made through a die in pairs, and split apart after delivery at the building. They are held to the joists by bent cleats of galvanized iron, each secured with two barbed wire nails. As the tiles are set in courses and break joints, it is not necessary to have them the exact length of the distance of joists from centers.



Section of Tile Ceiling, Plastered. Patent. July 21. '85.

The first-mentioned building was that of the Minneapolis Tribune Company. The fire, which was slow in making headway at first, as soon as it reached a broken ceiling spread between the tiles and the floor. Where this occurred under any heavy machinery it fell, carrying all the lower floors with it, and a total destruction soon followed. The second building above mentioned is the large six-story wall-paper warehouse situated on Randolph Street opposite Central Music Hall, Chicago, built for the late Martin Ryerson. It has open lofts with two rows of fire-proofed girders and columns. The girders and columns are all fire-proofed with porous terra-cotta, and the ceilings of the above-described tiles. The fire occurred on the second story near the center on the west side of the building, and raged for about one hour before it was subdued. Where it occurred were wooden cases from floor to ceiling, and bundles of wall paper piled on end to the same height. The hottest fire extended about half the length and half the width of the building, and when it was subdued the columns, girders, and ceiling were intact except that the plaster had fallen from the ceiling. In no place did fire penetrate to the third story. The color of the tiles was an ashen gray, showing the intensity of the heat, and the joints remained full of mortar. The tiles were set half an inch apart at the ends, and the first coat of plaster had formed a clinch, as between laths, so that when the plastering fell, leaving the tiles clean, the lime mortar clinch remained as a pointing for the joints. Not a single tile was cracked, and none of the fastenings were loosened. The repairs to this part of the building only consisted of plastering. The tiles of the first story ceiling held the weight of water until it was released by cutting a few holes. The advantage of thin tiles was demonstrated in the freedom from cracking, and their lower face was removed sufficiently from the joists (2½ ins.) to prevent them from charring, notwithstanding that the tiles must have been extremely hot. There can be no doubt but that, had the Minneapolis Tribune Building not been tampered with, no great disaster would have occurred.

The lesson to be learned from this experience is that fire-proof ceilings are only reliable when they form a perfect surface from wall to wall. When this is accomplished they may stand as severe fire tests as any other system on the surface. But the possibility of their being tampered with or broken by accident is an argument in favor of complete incombustible as well as fire-resisting construction. It may be noted also, as one of the curious facts connected with the experiences of those engaged in the business, that no fire-proof ceilings of the kind first described have been erected for ten years past, and none of the latter kind for six years.

Some experiences next to be considered are those of flat hollow-tile floor arches. When the Home Insurance Building was being erected at Chicago there was a hoisting engine on the ground floor, completely enclosed by a wooden shed, which, for his own convenience, the contractor had built of 2 in. planks. One night the shed took fire, probably from hot ashes dumped on the floor. It was under the center of the main hallway, and the floor above was built with 9 in. flat hollow-tile arches, which in this case were made of pure fire-clay from Eastern Ohio, which is the only fire-clay that will burn hard without other admixtures. The tiles had vertical and horizontal webs, making four air spaces in each. The house was almost entirely destroyed before the fire was discovered and extinguished, and the fire was so severe that some of the brass work on the engine was melted. The bottoms of a few of the tiles, which were not plastered, fell off, probably when water was applied, and all the upper air spaces were intact. As the parts of the tiles subjected to pressure were uninjured, they were not taken out, but patched up, and the ceiling subsequently plastered as it is to-day.

The Auditorium has been subjected to two fires, one when in process of erection, the other when in use. The flat floor arches are of porous terra-cotta, made at Pullman, Ill. The first fire was in a part of the building used as a glazing shop, and contained piles of empty glass boxes and refuse straw. These filled two rooms. Not being within the reach of any fire-extinguishing apparatus, they burned for nearly an hour until completely consumed. As stated by Mr. Adler, the architect, the injury to the building was confined to the burning of a number of window frames and sashes, to the breaking of glass and the burning of floor material. Neither the partitions, built of hollow porous terra-cotta blocks, nor the iron pillars and steel beams, protected by solid porous terra-cotta tiles, received the slightest injury, nor was the porous terra-cotta itself damaged to any considerable extent. The injury was doubtless much less than it would have been had water been applied. The second Auditorium fire occurred in the kitchen, from a pot of grease being spilled over a hot range. All the woodwork within 100 ft. as well as the shelving and kitchen stores were destroyed, but no damage was done to the fire-proofing or constructive iron work.

About a year ago there was a very severe fire on the eighth floor of the Ellsworth Office Building, a new fourteen-story building on Dearborn Street, Chicago. This is an office building with marble-finished halls and stairways and hardwood inside finish. The floors are of side-pressure porous terra-cotta hollow tiles, and the bottoms of the floor beams are set flush with the girders, so that the ceilings are flush throughout. The floor burned was occupied by a railroad company, and had no inside partitions. The halls, stairways, and elevators are in the center, and the suite of offices surrounded three sides of them. I have never seen an arrangement of interior fittings better calculated to make a good heat. There were pine cases from floor to ceiling, so close in some places as to have only alleys between for getting access to them, on the side of the building where the fire raged. They were filled with all kinds of filed-away papers. The fire occurred in the night, and burned away nearly all the cases and furniture on that side, showing different degrees of intensity as it worked around the hallway to the other side, where signs of heat, but not of fire, faded away to nothing. All the plaster fell from the ceiling for a space of about 20 by 50 ft., and in one place about 10 ft. square, the bottoms of about half of the tiles had fallen down. There was absolutely no injury to the floor above, except that some of the windows on the outside and in the partitions on the hall side were broken. There was no injury on the floor below except from water, and that was not serious as far as the building is concerned. The stairway was slightly injured only as to the marble work. But there was a failure in a matter of detail that came near resulting in serious loss.

A short distance from the center of fire, but at a place not sufficiently hot to destroy the bottoms of arch tiles or the protecting soffit tiles of the beams, was a girder. The tiles under this had been stuck in place, according to a common fashion, after the floor arches were built, and every one of them had fallen. But the heat was not sufficient to cause an expansion of the bottom of the beam after they had fallen, to produce any deflection visible after it had cooled. It was a narrow escape for the whole floor, and showed the folly of thus covering girders for the sole purpose of getting a flush ceiling. Had the method used in the best practise, of covering the bottoms of the girders with jaw-shaped tiles before building the arches, been employed, there would have been no danger. With the exception named, I consider this fire to have been the most satisfactory test of fire-proofing according to modern methods that has ever occurred in Chicago.

The most severe fire in a modern fire-proof building that has ever occurred in Chicago was that in the Athletic Club House before its completion. The fire occurred at the time when all buildings are in the most dangerous condition, and when architects and wise builders usually look to insurance rather than fire-proofing for the protection of their interests. It was, therefore, no such test as this building was required to stand when completed, and is not a fair illustration. But as a test of materials and methods was instructive. As is well known, the woodworkers had just commenced their work, and nearly all the finishing material was distributed through the building, so that there was an unusual abundance of fuel. Everything combustible above the ground floor was destroyed, the heat was most intense, and much of the stone work on the front was damaged; but yet there was no general collapse and all the floors held their places. The bottoms of the hollow tiles used for the floor arches fell in many cases, and the large steel columns were denuded of their porous terra-cotta covering in many cases, but still performed their duty. It was found that as many of these columns were designed to have hardwood paneling outside of the fire-proofing, wood blocks had been built into the fire-proofing to hold nails and screws, and it was doubtless the burning of these blocks that brought down the tiles. The tiles also were only built around the columns like walls, and had no special fastenings.

Mr. Adler, in a recent article, has described three fires that have occurred in the sixteen-story Schiller Building, at Chicago, but none of them resulted in serious damage except the last, and there was an easily avoidable cause for it. However, this is worth dwelling upon, for it caused some unnecessary excitement in the insurance community of Chicago, and the saying of many rash things against the methods of fire-proofers, which should have been addressed only to those who allowed bad material to be used in one building. This is not to say, however, that such has not been used elsewhere. It is unfortunately true that a great deal of inferior clay material has been used; but not by the regular fire-proofing contractors, who make a specialty of this business. Such materials are used by general contractors, who buy where they can get them the cheapest, and who avoid dealings with the regular fire-proofing companies for that purpose. The market is full of tile makers who have machines for making sewer pipes and drain tiles, who are always looking for such orders. It may be said for the contractors that they are not always experts enough to know where these materials are unreliable, and the fault lies with the architects and their superintendents, who do not take the proper means to find out what is good and what is bad in materials made of clay.

The first fire in the Schiller Building was an accidental one when it was in process of erection, and only destroyed part of the electric lighting wires. The second was such a curiously complicated chapter of accidents that it can only be given in Mr. Adler's words. "A workman engaged in repairing the damage of the first fire slipped from his footing on a scaffold. In falling he entangled some electric lighting wires with a gas pipe, caused a short circuit, melted the pipe, lighted the gas, the rubber wire covering, and wooden conduits, and kindled a blaze which caused more damage than the first one."

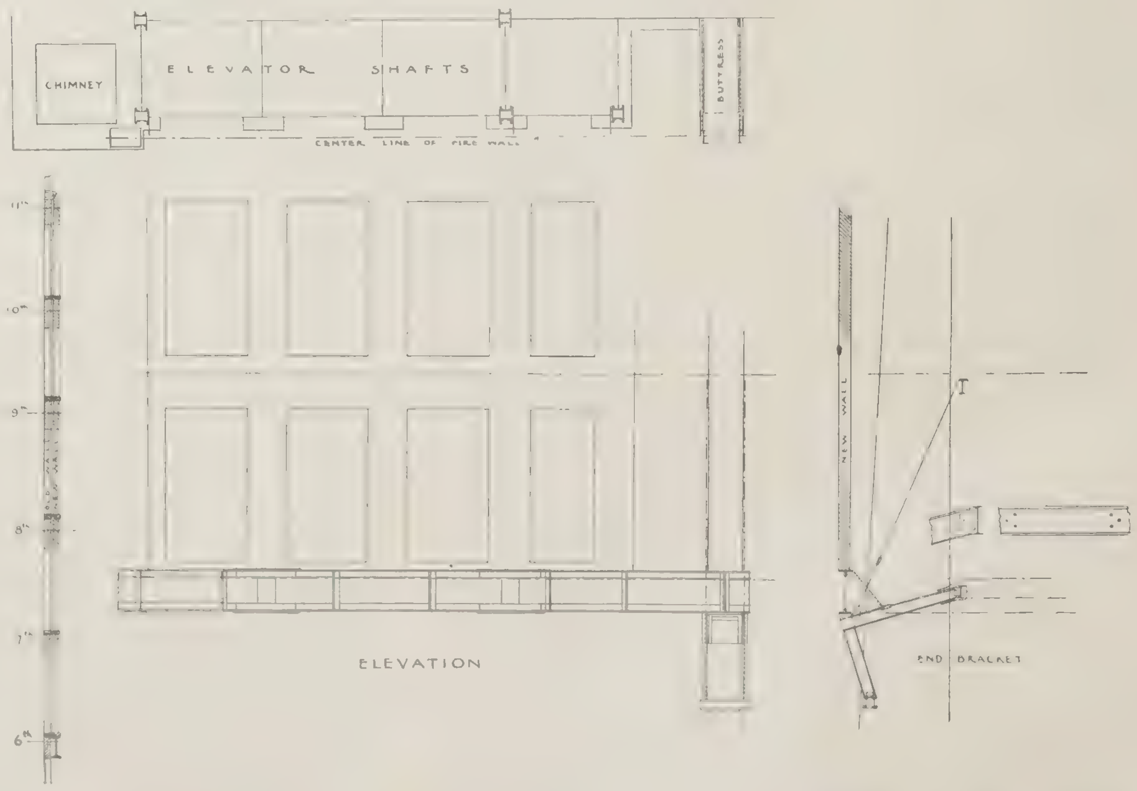
The third and serious fire was in an adjoining building used as a cigar factory. This was only four stories high, while the Schiller is sixteen. It was 28 ft. from one of the walls of the Schiller, which consists of a skeleton of steel with outside and inside shells of hollow partition tiles. In the upper part where it is visible from the street the outer shell is of hand-made terra-cotta blocks. The wind was from the east, and the whole force of the fire was against that part of the east wall faced with hollow tiles. There are numerous windows in the wall, of which all reached by the flames were broken and their sashes and frames burned out. The flames and hot draft blown into the rooms were sufficient to break the glass in openings onto the corridor, and in some cases across on the other side of the corridor on which these rooms open. The damage from fire within the rooms was confined to the blistering of paint and scorching of such office furnishings as were near the windows. But the heat of the burning building caused the tiles of the outer skin of the building to flake off, and in some cases to fall, so that the building was dependent upon the inner skin for its protection. But the upper wall of good hard-burned facing terra-cotta was uninjured. I have Mr. Adler's authority for saying that the hollow tiles used in the outer skin were *made of ordinary brick clay — not of fire-clay* — and thereby hangs the tale that I have told above. Enough of the tiles, however, remained in place to protect the steel structure that was uninjured.

My last recital will be the story of a building that was a total failure through bad fire-proofing methods, or rather the want of good ones. It has been the cause of a great deal of excitement and much foolish talk through the inability of the critics of fire-proof buildings to comprehend what was the nature of its details. Only one scientific journal has found out the actual truth about it, and is entitled to great credit for so doing. Some time ago the entire upper part of the Manhattan Bank Building, situated at the north-east corner of Broadway and Bleecker Street, a so-called fire-proof building, was destroyed. It is an eight-story building, 50 by 150 ft., constructed six years ago, since the period within which all well-informed architects have recognized that all constructive materials of iron or steel should be protected by a fire-resisting covering, to render any structure fire-proof. The story is a short one. An old-style six-story building on the south side of Bleecker Street, which is about 40 ft. wide, was totally destroyed. A south wind blew the flames against the wall of the Manhattan Building. All the large windows of the upper part were broken, and the window frames, internal fittings, and goods took fire in the very face of the fire department which was operating against the first-mentioned building. Before the fire could be subdued part of the roof and of the eighth and seventh floors fell, bringing down a large section of the wall on the Bleecker Street side, and a beam falling down the stairway well wrecked the iron and marble stairway to the second story floor. We are indebted to the *Engineering Record* of New York for being the only journal to send an expert to investigate the cause of all this destruction (for a full account of which, see the *Engineering Record* for Nov. 16, 1895). In brief, he found that the floors and roof were all supported on unprotected box girders of great depth, crossing the building supported by the brick backing of the Bleecker Street wall, and cast-iron columns built partially into the party wall on the other side, which columns were not continuous, but the girders rested on the tops of them and came between the top of one column and the base of another; that these girders carried longitudinal 15 in. I beams 4 ft. from centers on angle iron shelves on their sides; that there were ceiling tiles 5 by 15 ins., hollow, and with two webs each, resting on 2 by 2 in. T irons, 30 ins. from centers, which were supported on the lower flanges of the beams. These supported nothing and were plastered on the under side, the plastering being continued under the T's and I beams and forming their only protection. The floors were of double 2 in. planking laid on the beams. The roof was covered with flat tiles, and fire-proof on the top only. Columns and girders were all exposed, and it is clear to any one that it was a break-neck race between the girders, the beams, or the light T irons to see which would go down first. In this contest the tiles, which were undoubtedly fire resisting in themselves, had nothing to do but to tumble down when their time came. It is fortunate that the building did not burn from the bottom, for the first girder that would have buckled in that part might have acted like a lever and pried the superincumbent columns off their bearings. Words are almost wasted over such construction, and it would not be worth mentioning but for the fact that this so-called fire-proof ceiling is patented and other buildings have been treated on this plan, one of which, I know, is in St. Louis. As the expert of the *Engineering Record* said at the time, "If the building had been constructed according to the recognized best practise, there is no reason to doubt that it would have escaped serious injury other than the defacement of walls and exterior woodwork and the destruction of such of its contents and interior woodwork as were separately ignited, and were in no way related to the safety or fire-proof qualities of the building."

FIRE SHIELD FOR THE PABST BUILDING, MILWAUKEE.

A FEW years ago there occurred in a Chicago building a fire of sufficient intensity to do considerable damage to the party wall of the high Schiller Building immediately adjoining, the heat disintegrating the relatively thin brickwork sufficiently to suggest a fear of possible collapse of the steel framework. This fire was considerably commented upon at the time. To guard against a similar possible catastrophe, one of the party walls of the Pabst Building, in Milwaukee, has been protected, or fireproofed, in a manner which is of considerable interest. The details of construction are indicated by the drawings published herewith. The Pabst Building is an eleven-story steel skeleton structure. The elevators adjoin the party wall, which is 8 ins. thick, partially enclosing the steel columns of the frame in such manner that only 4 ins. of brickwork protects the outer flanges of the columns. Immediately adjoining is a five-story building which is used as a furniture factory, and is filled with oils, varnishes, and other inflammable substances. In the event of a fire breaking out in this building, the inflammable nature of its contents would jeopardize the elevator shaft in the Pabst Building, and it was thought necessary to devise some system of protection by which, in case of such a fire, the columns in the Pabst Building could not be sufficiently influenced by the heat to cause them to warp out of plumb and so prevent the running of the elevators. For this purpose an 8 in. brick wall or fire shield was built immediately outside of the original wall in the Pabst Building, this fire shield beginning at the sixth floor or immediately above the wall of the adjoining building and being carried to the eleventh floor. This shield is borne by a plate girder 39 ft. 3 ins. long and 30 ins. deep, which rests at one end on a projecting brick chimney of the Pabst Building, and at the other on a riveted bracket which straddles a buttress wall and is hung to the beams of the sixth and seventh floors. Owing to the contracted space it was necessary to build the girder in three parts, hoist each piece separately into position, and splice the two joints. The fire shield was built of No. 1 fire brick laid up in Portland cement mortar with ⅛ in. joints, and was anchored to the old brick wall very carefully. Openings in this fire wall, corresponding to the openings in the main elevator wall, were left at each story, and were fitted with wooden shutters covered with tin. To protect the girder itself, which would naturally be a very vital part of the construction, all of the exposed steel was covered with 2 ins. of pine plank, and the plank in turn covered with tin.

It is believed that this is the first time that an extended fire shield has been used for protecting an exterior wall of a building. It was assumed that such a wall covering five stories, and having a height of about 65 ft., would be sufficient protection against any fire which might occur in the adjoining building. The use of wood to protect steel against the action of heat is a novel one in this connection, and would not be permitted by the building laws of our larger cities. In the strict meaning of the words, the wood acts as a heat insulator and fire retardant rather than a fireproofing, but the use of tin-covered wooden shutters has met the approval of underwriters and engineers for many years, and as a matter of fact it is probable that any fire in the adjoining structure would be quite burned out before the wooden protection of the steel girder could be consumed. The action of excessive heat would be to carbonize the wood, increasing rather than lessening its resisting qualities. This construction was devised and executed by Mr. Albert H. Wolf, consulting and contracting engineer, to whom we are indebted for the description and the drawings.



Mortar and Concrete.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.

CEMENT TESTING.

(*Continuation of tests made by Prof. Cecil B. Smith.*)

COMPRESSIVE TESTS.

THESE are doubtless more valuable than tensile ones, in the sense that we use mortar usually in compression. There are several reasons, however, why such tests are not really needed: —

1. Because the strong machinery needed would not be generally available.

2. Because the compressive strength, after all, varies quite regularly with the tensile, being 5 to 6 times as great at 1 week or 4 weeks and gradually increasing to 9 to 10 times as great at a year, because by this time the cement is becoming brittle, and has attained its maximum tensile strength. This is more particularly true of Portland cements, as naturals do not get so brittle.

3. Because the compressive strength of cement mortar is so great that we need seldom concern ourselves with it, but should rather know the adhesive and tensile strengths, should they ever be called into play, and, moreover, the strength of mortar in thin joints is much greater than in cubes. Tests on cubes always go higher for small cubes than for large ones. (See also series [IV*a*] tests of mortar joints in brick piers.)

TRANSVERSE TESTS

Have often been advocated, and the machinery needed may be quite simple; but there are two objections which would preclude there being any great value in such tests: —

1. Because the coefficients of rupture in transverse testing are known to be at fault in not really indicating the tensile strength of the outer layer or fiber. This could possibly be avoided by determining certain corrections, as a thesis paper to the *Engineering News* pointed out: —

2. The main objection is that a flaw of a very slight amount may be objectionable in such tests if situated near the tension face. Any cement tester knows that bubbles will occur. They may be very minute, or if of any size may be deducted in tensile tests, while in transverse tests, who could determine the correction to be made? Also tests made show that if tested upside down from position molded, the results are higher than when tested as molded. Altogether, this method of testing does not seem to commend itself to general use.

To conclude the subject of ordinary testing for commercial purposes, and with the addition of chemical analysis where available for scientific ones also, the following seems to be a good basis to work on, that 4 tests should be made in combination: —

1. Specific gravity 3.10 for Portlands, 2.95 for naturals.

2. Blowing test. In the absence of really final knowledge on the subject to continue to specify pats in steam at 115°F. for four hours, in water at 115°F. for twenty hours, at which time if the pats are stuck tight to the ground glass, the cement may be considered safe, while if it has loosened from the plate but has not yet cracked or warped, it may be immersed again for twenty-four hours at 115°F., or else placed in water of ordinary temperature for four weeks, after which, if no further signs have developed, the cement may be considered safe.

(3) Fineness: —

10 p. c. residue on No. 80 sieve }
and 20 p. c. „ „ „ 120 „ } as maximum.

(4) Tensile strength: —

		Portland.	Naturals.
Minimum neat	3 days	250	75
„ „	1 week	350	100
„ „	4 weeks	450	200

1 to 1 and 3 to 1 sand tests with 20 p. c. water, and 20 lbs. per square inch pressure to be determined by tests made and results furnished within the next year.

SERIES I.

SPECIAL TESTS.

On the effect of fine grinding: —

(*a*) 2 oz. cement passing No. 120 sieve . . . Cement
2 oz. „ caught on No. 120 sieve }
2 oz. „ „ „ No. 80 sieve } . . . Sand
2 oz. sand }

tested at 4 weeks gave 165 lbs., while

2 oz. cement passing No. 120 sieve . . . Cement
6 oz. sand . . . . Sand

gave 121 lbs. tested at the same age.

Thus, if in the first instance we consider all but the finest as sand, then our result is only 35 per cent. higher than the 2d mixture, showing of how little value the coarser particles were.

(*b*) No. 8 English Portland (very coarse) gave in ordinary test 414 lbs. 1 week neat, 528 lbs. 4 weeks neat; but when all the particles caught on No. 80 sieve were rejected, the results were 393 lbs. in 1 week, 484 lbs. in 4 weeks, demonstrating the well-known fact that neat tests of Portlands operate against fine grinding, and therefore should be considered only in connection with fineness and specific gravity.

(*c*) Equal portions (same brand) of residues on No. 50 and No. 80 sieve were mixed with 22½ per cent. water, and gave 262 lbs. in 1 week and 324 lbs. in 4 weeks, which is very surprising, and can only be accounted for on the ground that the dust of cement clinging onto the coarse particles was sufficient to hold them together, or else that the mechanical action of mixing the mortar broke up many coarse particles into finer ones.

(*d*) To show the superior value of fine cement in sand mixtures, the following results have been obtained: —

	1 to 1.		2 to 1		3 to 1.	
	Ordinary.	Fine on 120 Sieve.	Ordinary.	Fine on 120 Sieve	Ordinary.	Fine on 120 Sieve.
No. 2 Natural 1 week 20% water 20 lbs. pressure.	114	190	......	......	......	......
No. 2 Natural 4 week 15% water tamped	98	65	......	......	......	......
No. 2 Natural 4 week 15% water tamped........	145	123	......	......	......	......
No. 15 Natural 1 week 20% water 20 lbs. pressure	166	229	......	......	......	......
No. 15 Natural 4 week 14% water tamped........	......	......	77	125	......	......
Brand A Natural 4 week 20% water tamped......	31	39	......	......	......	......
No. 3 Portland 4 week 12% water tamped........	......	......	......	......	72	121
No. 3 Portland 4 week 20% water 20 lbs. pressure.	......	......	......	......	47	100
No. 9 Portland 4 week 20% water 20 lbs pressure.	......	......	......	......	49	109
No. 5 Portland 4 week 12% water tamped........	......	......	......	......	82	102
No. 6 Portland 4 week 12% water tamped........	......	......	......	......	126	188

These results should be a convincing argument to users of Portland cement that fine grinding is worth paying for, because the finer the same cement the greater its sand-carrying value is.

The only partial exception in the above results is No. 2 natural. This is either erratic, being, however, duplicated, or if not, is easily accounted for. An underburnt cement is easily ground, and therefore is not apt to be *well* ground; very easy grinding will make it fine enough, and the better burnt particles being a little *better* burnt are, therefore, harder and escape grinding; but these particles, not being very hard, are probably bruised up in mixing, and form the best part of the cementing substance; therefore, when those are sifted out, the underburnt fine particle has not as great a cementing value as the mixture would have unsifted. On the other hand, the coarse particles in Portland cement are much harder, and are always a detriment in a sand mixture.

SERIES II.

HOT WATER TESTS.

(*a*) No. 1 Natural cement neat, 2 months old, gave when tested the following results: —

(1) Water at temperature 52° F., 226 lbs. average.
(2) " " " 122° F., 250 lbs. average.

(*b*) No. 1 Natural cement 1 to 1, 2 months old, gave when tested the following results: —

(1) Water at temperature 47° F., 125 lbs. average.
(2) " " " 118° F., 129 lbs. average.

(*c*) No. 4 Portland, neat, 1 month old, gave when tested the following results: —

(1) Water at temperature 65° F., 533 lbs. average.
(2) " " " 118° F., 616 lbs. average.
(3) " " " 186° F., 556 lbs. average.

(*d*) No. 4 Portland, 3 to 1, 1 month old, gave when tested the following results: —

(1) Water at temperature 66° F., 81 lbs. average.
(2) " " " 183° F., 81 lbs. average.

These tests, which are very uniform, indicate that for either natural or Portland cements tested neat or with sand, there is a slight gain in strength, by using hot water in mixing.

The *advantage* being that for exposure to frost the cement will set quicker and resist the frost action better. By referring ahead to frost tests, it will be seen that cements exposed at about same temperature (natural cement only tested with hot water in frost) gave much higher results when mixed with hot water, being in ratio, 94 to 0 for neat cement No. 1 Natural, and 117 to 44 for 1 to 1 cement No. 1 Natural.

SERIES III.

FROST OR EXPOSURE TESTS.

This series consisted of various investigations into the strength of mortars when mixed with different conditions of water and under different exposures, reference being particularly made to frost. All tests were made in quadruplicate.

The first set was submerged, after 24 hours, in water of laboratory tanks.

The second set was kept on damp boards in a closed tank for the whole period, and never allowed to dry out.

The third set was allowed to set in the laboratory, and then exposed to the severe frost and left in open air for the whole period.

The fourth set was exposed in from 8 to 10 minutes to the severe frost, and left there for the whole period, except to take them out of the molds when they were set or frozen.

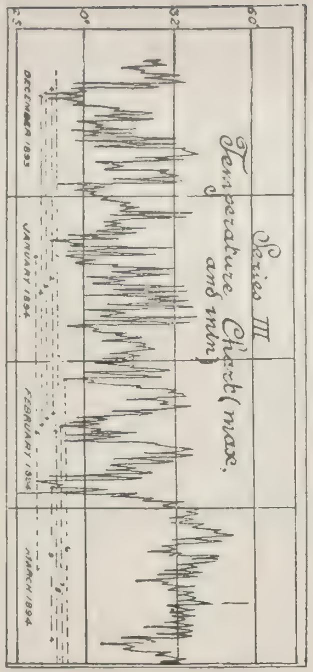


Table V is here given, showing the results obtained, and accompanying it is a temperature chart showing the weather to which these mixtures were exposed during their whole period.

It will be noticed that these tests were purposely made in cold snaps so as to make the tests as severe as possible.

It would appear improbable that mortar immediately exposed to severe frost would become stronger than that allowed to set in a warm atmosphere, but the results of all the Portland cement tests, both in tension and compression (with one exception) assert it; and also that those allowed to set in the laboratory, and then exposed continually, are the weakest of all the four conditions treated of. This would go far to dispute the advisability of covering up mortar laid in frosty weather.

The next deduction from the Portland cement tests is that laboratory tests made with briquettes submerged give higher results than can be expected in open air work, and therefore that engineers should add this to the various other degenerating contingencies, such as bad mixing, dirty sand, etc. A deduction not much evidenced in the table is that it is not safe to lay Portland cement mortar below 0° F. because the third and fourth series of 3 to 1 Portland exposed at —6° F. gave ocular evidence that their structure was injured, and the test-pieces broke most irregularly, while the other exposures at about 0° F. gave no evidence of any injury at all. Coming to the natural cement mortar in the fifth and sixth lines, we find much different results. The first one is decisive, and is that this particular cement mortar cannot be laid in zero weather. The first set were all blown to pieces (except the cube), which surprisingly stood 1390 lbs. while the second set, although not quite blown to pieces, all showed extreme injury.

The most peculiar result is that this same cement, neat, if given a few hours to set in the temperate air, will on exposure to the frost attain a strength highest of the 4 conditions; this is quite remarkable, that while the Portland cement was strongest when submerged, the natural cement was stronger in damp air and strongest in frost.

Indeed, the Portland cement, in air, for 1 to 1 mixtures, was very little stronger than the 1 to 1 natural.

TABLE V.

FROST OR EXPOSURE TESTS. SERIES III.

Mixture.	Age.	Tensile Strength.				Compressive Strength.				Dates of Exposure.	Temperature of Exposure for 3.	Temperature of Exposure for 4.	Time from mixing till exposure.	Natural time of set.	No. of tests.	REMARKS.
		Water test. (1)	Damp air test. (2)	Exposure after setting. (3)	Exposure before setting. (4)	1	2	3	4							
No. 11. Portland Neat.	2 mos.	602	471	282	334					Dec. 6th to Feb. 6th.	+23° F.	+22° F.	30′ (3) 12′ (4)	25′	16	
1 to 1.	"	377	276	194	233	3200	1780	1600	1900	Dec. 11th to Feb. 11th	+5° F.	+3½° F.	40′ (3) 8′ (4)	35′	20	
2 to 1.	"	168	150	105	111	800	720	660	440	Dec. 12th to Feb. 12th.	—½° F.	0° F.	40′ (3) 10′ (4)	37′	24	
3 to 1.	"	104	86	92	97	300	520	230	300	Dec. 13th to Feb. 13th.	—5° F.	—6° F.	1° 27′ (3) 10′ (4)	1° 25′	24	Nos. 3 and 4 showed irregular and injured fractures.
No. 1. Natural Neat.	"	226	221	349	0	1600	1500	2300	1390	Jan. 12th to Mar. 12th.	+2° F.	+5° F.	4° 15′ (3) 11′ (4)	4° 15′	24	No. 4 tension completely blown in fragments.
1 to 1.	"	125	229	187	44			0	800	Feb. 5th to April 5th.	+8° F.	+4/10° F.	8° 0′ (3) 10′ (4)	8° 00′	22	Some of No. 4 tension injured and No. 3 compression.
Neat.	"	250	281	159	94	2800	2000	3300	1300	Feb. 13th to April 13th.	+13° F.	+5° F.	6° 0′ (3) 10′ (4)	6° 0′	24	Mixed with water at temperature 122° F.
1 to 1.	"	129	170	80	117					Feb. 14th to April 14th.	+9° F.	0° F.	3° 0′ (3) 8′ (4)	2° 50′	20	Mixed with water at temperature 118° F.
Neat.	1 mo.	155	278	217	249					Feb. 26th to Mar. 26th.	+17° F.	+7½° F.	7° 0′ (3) 9′ (4)	7° 0′	20	Mixed with 2% brine.

All of the natural cement specimens exposed to frost showed a disintegrated layer on the outside about ⅛ in. thick; underneath this the structure was quite sound, and doubtless much of the variations in tests is due not so much to a weakening through the whole mass as to a reduced sectional area.

The last series made with 2 per cent. brine in mild weather for 1 month (exposed at + 7½° F.) showed that salt increased the strength, making them as strong as others were at 2 months when mixed with fresh water, and also again emphasized the advantage to this natural cement of open-air tests.

It would seem that either hot water or salt are therefore very strengthening in their effect.

(*To be continued.*)

CORRECTION IN TABLES, AMERICAN CEMENT SERIES.

OUR attention has been called to some errors in the tables of standard cement tests which were published in our October number. Table No. 1 stated that the German Government regulations of 1893 prescribe, under the head of "Constancy of Volume," 23 hours in air, and 1 hour boiling or submerged 28 days, no checking in either case.

Professor Smith writes that the German regulations provide only for 28 days in cold water as the test for checking.

Also, in Table 1, Canada Chemical Analysis, lime should be 60.05% for Portland.

Also, Strength Tests, Canada, should read "not yet specified; to be reported on 1 year later."

Also, Setting Qualities, England, Vicat needle test, should be $\frac{66}{100}$ lbs. instead of 66 lbs.

These errors appear in the report of the Canadian Society of Civil Engineers, from which our tables were copied.

Professor Smith also writes as follows:—

"I would like to mention that in 1894 the C. S. C. E. fixed on a final cement report which is quite a bit more full than the one of 1893. The residues on sieves are fixed at

0.0% on No. 50 sieve.
10.0% on No. 100 sieve.

"Steady pressure of 20 lbs. per square inch, and 20% of water is specified for methods of putting sand briquettes into molds.

"Strengths specified are

Neat	3 days	250 lbs.	per	square	inch.
„	1 week	350	„	„	„	„
„	4 weeks	450	„	„	„	„

as minimums for Portlands, while sand strengths and all natural cements are left undefined."— EDITOR.

SPECIFICATIONS FOR CEMENT WALKS.

REPLYING to several inquiries that have been made in one form or another regarding the proper methods and materials to be used in the building of cement walks, the following suggestions are submitted as covering in a general way the whole subject.

Depending upon the character of the soil, climate, and surroundings, the location of the walk is to be excavated to such a depth as may be necessary below grade, 10 to 18 ins., and the excavation filled and well rammed to within 4 or 5 ins. of the surface of the proposed walk with broken stone or bricks, coarse gravel, cinders, or any similar material which will give a suitable base course. Walks at the foot of a terrace, or those subjected to seepage from soil upon higher grades, should be provided with suitable tile trains for their protection.

Wooden strips, 4 to 6 ins. deep and about 2 ins. wide, are then staked along the lines of the walk and about tree spaces, where there is no stone curb. These must be carefully leveled and brought to grade to produce a good piece of work.

Upon the thoroughly compacted base, 3 or 4 ins. of cement concrete and 1 in. of Portland cement mortar, covered by a thin, dry surface coat, are laid.

The cement in use should be the best quality of high-grade, slow-setting Portland cement, equal in quality to the best German brand. Several American Portland cements have given good results.

The sand should be a clean, sharp, rather coarse, concrete sand.

Either broken stone or coarse gravel may be used. The stone should pass a ring 2 ins. in diameter.

CONCRETE.— The mortar for the concrete should be made of cement and sand in the proportion of one to two, thoroughly mixed dry, and then with a sufficient quantity of water to form a mortar which should not run, but should be rather dry and stiff. This will, of course, require much more working than the ordinary sloppy mortar. To this mortar the broken stone or gravel, or a mixture of the two, is added in such proportion as to leave a slight excess of mortar over that necessary to fill the voids in the stone. Four parts of stone to each part of cement will usually make a rich concrete, and often more can be used with a mixture of stone and gravel or with a graded gravel.

The stone or gravel should be sprinkled with water and drained before it is added to the mortar.

The mixing should be done upon a water-tight mortar board, the mortar being spread out as thin as possible, and the stone deposited upon it. The mass is then thrown up into the middle of the board, cut back and forth three or four times, when, if all the stone or gravel is well covered with mortar, it is ready to lay upon the base, where it is spread and rammed until free mortar appears on the surface. The base should, of course, be sprinkled, and the concrete should not be simply thrown off the shovel employed in moving it from the mixing board, but it should be deposited with a turn which brings the bottom of the shovel uppermost and allows the contents to drop at once in place without any separation of mortar and stone.

Blocks must then be marked off of the size required in the finished walk, and the joints deeply cut and filled with dry sand, or separated by tarred paper. They should be about 3 to 6 ft. square, and it is best not to vary from this rule and to avoid long blocks.

SURFACE.— The mortar for surface should consist of equal parts of the specified Portland cement and sand, mixed rather dry. This should be spread to the depth of 1 in. upon the concrete previously laid, while the latter is still moist and fresh, and after the strips of wood at the edges of the walk have been releveled. It is well manipulated with wooden floats and brought to a true surface, when a small amount of water should appear. This floating or troweling should not be continued too long or cracks will be produced.

If a good surface is attained in this way nothing further need be done, but it is usually more satisfactory to have a slight excess of water on the surface and then to apply a dry coat, a dry mixture of equal parts of *fine* sand and cement to which some lampblack has been added as a coloring agent, at the rate of 1 lb. or more to the barrel of cement. This is dusted by hand upon the moist surface of the walk and carefully floated and tooled, which requires some skill, until a fine appearance is attained. No neat cement should be used as a dry coat, nor should the surface mixture be too dry before the application of the dry coat. Unless care is taken that each coat is fresh and moist before the addition of the following one, the pavement will not be monolithic and will not withstand frost.

The slabs, after the surface is finished, are rolled with a toothed brass roller, if desired, to within an inch of their edges, along which lines are drawn, or they may be left plain with beveled edges.

The pavement should be protected from the sun or cold weather until set, and should preferably be watered two or three times for the next few days to promote setting. It should be thoroughly cleaned also to prevent stains.

With 4 in. concrete and 1 in. surface, about 8 lbs. of cement is required for each square foot.

The Masons' Department.

THE ARCHITECT AND CONTRACTOR.— EXTRAS.

BY THOMAS A. FOX.

(*Continued.*)

IT has been shown in the previous papers that for various reasons it is practically impossible to complete a building of any considerable size or importance without it being necessary to have more or less work done in addition to that which was called for under the contract. This, of course, necessitates a certain number of extras, and as most owners feel instinctively, in regard to such work, either that it should have been included in the contract or that the charge for it is excessive, it is greatly for the interest of the architect, on account of his reputation, and the builder, because of the consideration involved, to have the orders for all extra work executed in such a way and at such a time as to guard so far as possible against the misunderstandings which so frequently arise over these matters, and which usually come at a most unfortunate time; that is to say, when the final settlement is being made. There are two simple rules in regard to extras which, if followed, will reduce the trouble caused by them to the minimum. First, all extras should be ordered in strict accordance with the terms of the contract; and second, the owner's written approval should be obtained for each extra at the time it is ordered, which, as a matter of fact, is often required by the contract; and it is not only the right but the duty of the contractor to see that these rules are enforced, for in a large majority of cases he will be the loser if they are not followed, and should the issue be fought out in court, he will be most likely to lose his case. " It constantly happens," says an English justice, who puts the case so clearly that it is worth while to quote at some length, " that in course of the performance of a contract, certain deviations and additions are required, and it almost as constantly happens that the contract contains a clause that the party who asks for these deviations and additions is not liable to pay for them, unless some condition is performed which is to operate as a security for the price to be charged for them. But again, almost as constantly, the party who executes such orders, trusting to the spoken words of the other, takes no care to see that the condition is performed, which is necessary to entitle him to payment." These observations point out clearly the circumstances which usually give rise to disputes as to extras. That is to say, if the contract provides that extra work shall be done only upon the written order of the architect, and such is the provision of most building contracts, the contractor must have such authority if he wishes to be in a position to enforce his claim, unless the provision is legally waived, which is seldom done. And furthermore, the order must be obtained before the work is executed, "for the want of a previous order is not supplied by an order given subsequent to performance." Such being the law, the contractor must realize that if disputes, involving extra work, were carried into court, there would be comparatively few cases where he could produce the necessary written order obtained before the work in question had been performed. While, as a matter of fact, it is almost impossible, for a variety of practical reasons, which it is unnecessary to consider here, to issue orders for all extra work in strictly legal form, the contractor has a perfect right to demand the proper authority, and should not be required to jeopardize a just claim for additional payment on account of any whim or prejudice of the architect or owner, as he is frequently called upon to do.

Not long ago, an architect, who prides himself that his office is run on strictly business principles, telephoned to an iron contractor to send at once to a certain building some beams which were not called for by the drawings. The contractor, who had apparently learned wisdom by experience, replied that as this was extra work, which fact was acknowledged by the architect, the beams would not be delivered except on receipt of a written order, signed by the owner. The architect said that to comply with such an unreasonable demand would delay the work, and he should order the beams elsewhere, which he did. Not long afterwards, when this same contractor started to figure a piece of work in the office of this business-like architect, he was told his time would be wasted, as an estimate from such an unreasonable and disobliging concern would not be entertained. Here was a case where a person suffered for simply demanding the rights to which he was entitled, and such instances are of quite frequent occurrence. Orders for extra work are often withheld because, in the opinion of the owner or architect, the price given for the work is excessive; but under the uniform contract, and in fact, under most other forms, this constitutes no valid reason for refusing to issue the order, for it is provided that in case of dissent from the award of the architect the valuation of the work shall be left to disinterested arbitrators, whose decision shall be final and binding. It usually seems easier to the architect at the time an extra comes up, especially if he is not sure the owner will approve it, to defer settlement until the final adjustment of the accounts, often with the hope that some saving can be made to offset it; but in point of fact, such a course is sure to aggravate the difficulties; for while an owner is often willing to take his medicine when administered from time to time in small doses, he is very likely to refuse to swallow the potion when in the state of financial exhaustion, real or imaginary, in which he thinks himself when he is called upon to close the accounts. Most architects have special blanks made to fill out for extra work or work omitted from the contract, but the temptation for the architect to procrastinate is so strong, and the contractor, on his part, is so often unwilling to demand his rights, for fear of giving offense, that the owner is left in blissful ignorance of the true condition of things, until at the close of the work he is confronted by a bill which leads him to think that the architect and builder have conspired to accomplish his financial ruin. The principle of " pay as you go " cannot be better applied than in dealing with extras on a building contract. It is the business of the contractor, except in unusual cases, to demand and receive a proper order for extra work before it is executed. It is the duty of the architect to recognize all reasonable requests of this nature, and it is incumbent on the owner to honor such drafts when they are presented for payment. In addition to those already given there is another important reason for issuing orders for extra work at the time such work is executed, which is, that as most orders are framed the additional sum to be paid is added to and becomes a part of the contract price, which enables the contractor to draw money on account of such work, which he is certainly entitled to do, and, moreover, the work is then paid for by the owner on the instalment plan, and he is less ready to question the amount than if it was presented to him in a lump sum. The question as to authority to sign orders for extras should sometimes demand the attention of the contractor. The uniform contract places this power entirely in the hands of the architect, which, in this particular form, is probably all that is necessary, as in a previous paragraph, where the architect is named, he is authorized to act for the purpose of the contract as the agent of the owner. But an able writer on such matters well says, in speaking of such a provision, " In other words, the person for whom the house is built, who pays for it and expects to live in it, cannot make any changes in it as the work goes on; while the architect, with whom he may not perhaps be on the most friendly terms, is empowered to make any changes or additions that he chooses, without his knowledge or consent, and compel him to pay for them. It is surprising that any owner should be found willing to employ an architect on such terms, or that architects should be willing to assume such absolute control over the wishes and fortunes of their clients." It is undoubtedly better to provide that all orders for extra work shall be signed by both owner and architect, and the only objection of importance to such a requirement is that it may cause a delay in issuing the order, but this is, of course, of minor importance compared with the advantages gained.

(*To be continued.*)

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

CHICAGO.— A letter on fire-proofing has just appeared in the Chicago *Economist*. Gen. Wm. Sooysmith, the well-known engineer, writes to point out in high-building construction the dangers from corrosion of steel from the use of inefficient fire-proofing, and of unequal expansion of steel framing and its covering. He ends his letter by claiming to have discovered materials better than the ordinary "so-called fire-proofing," and also a method which, he says, will "protect the iron and steel in a building from corrosion absolutely." He does not, however, state what these methods and substances are.

RESIDENCE FOR H. K. CUMMINGS, ESQ., GERMANTOWN, PA.
Frank Miles Day & Bro., Architects. Scale drawings of this building shown on plates 71, 72, 73, and 74.

There is no boom in Chicago building; it seems duller here than in other cities. But there has been a feeling of confidence since election. Contracts have been let for several buildings, mentioned previously in these columns.

Geo. A. Fuller & Co. have the contract for the Fair, Jenney & Mundie, architects. In this connection it might be remarked that the tendency now seems to be to let straight contracts instead of building on a commission, as has been done very largely in the past.

Jenney & Mundie have also let the contract for the additional three stories on the Royal Insurance Building. Grace & Hyde took this work. Other contracts let recently are: The Donnelly Manufactory Building, cost, $105,000; S. A. Treat & Howard Shaw, architects, and the Waller Apartment Building. Bishop & Colcord, architects, report several apartment and other buildings in hand. Jul de Horvath expects to let contracts shortly in San Antonio, Tex., for two buildings costing over $400,000.

The last issue of THE BRICKBUILDER contained an editorial favoring the setting of terra-cotta, not by brick-masons, but by specially trained men. This sentiment is certainly approved in Chicago, where it is the custom in all the best work, even where not the entire fronts, but only the band courses and trimmings are of terra-cotta, for the manufacturer to send, at the proper time, his own skilled terra-cotta setters to lay up all his part of the work.

Attention might be drawn again in this column to the race between two buildings, one under the Government's control, the other belonging to a private corporation. The walls of the magnificent Illinois Trust and Savings Bank Building will be soon up to the cornice line, and sculptors in the studio are getting ready the interior plaster decorations. The cornice of the old Post-Office Building, on the other hand, is in part still standing, and the newspapers are beginning to talk about the Federal Government not being able to tear down a building in the same time it takes a banking corporation to tear down, rebuild, and move in for business.

Mr. D. Adler lectured before the Chicago Architectural Club recently on the relation of steel and plate glass to architecture. This is a reminder of the subject of building show windows out on the sidewalks, which has been referred to before in these columns. A great deal of this special dispensation work has been done in Chicago in the year past. Lately, when the city council was asked for a permit to project show windows from one important building, a precedent was established of requiring rental to the city for space thus occupied. If the precedent can be made to stick, the city treasury, and not the aldermen, will profit by the objectionable narrowing of crowded streets.

ST. LOUIS.— The completion of the Century Building with its four hundred offices, with other buildings that are nearly completed, will add at least a thousand more desirable offices to what seems already quite enough.

This seemingly excessive number does not, however deter others from investing in similar enterprises.

Architect W. A. Swasey has awarded the contract for the Fullerton Building, on the corner of 7th and Pine Streets, to Chicago parties. It is to be twelve stories, and, judging from the drawings, will compare favorably with any in the city.

Besides this, the air is filled with rumors of skyscrapers of more or less magnitude; among them a twenty-two-story building on Olive and 7th Streets, a large one on Pine and 6th Streets, another on Pine near 9th Street, while drawings are said to be completed for an eighteen-story building on Olive and 6th Streets.

As to whether any of these will be built in the near future is problematic, but several large warehouses in the Cupples district are meeting with far more serious consideration, drawings being now prepared for two which are to be commenced at once.

It is rather early yet to form any correct estimate of the result of the recent election upon the building interests. There is some of the work that was stopped, awaiting the result of the issue, that is now going ahead, while the close of the business season, together

CAMDEN SAFE DEPOSIT & TRUST CO. BUILDING, CAMDEN, N. J.
Frank Miles Day & Bro., Architects.
Architectural Terra-Cotta made by Perth Amboy Terra-Cotta Company.

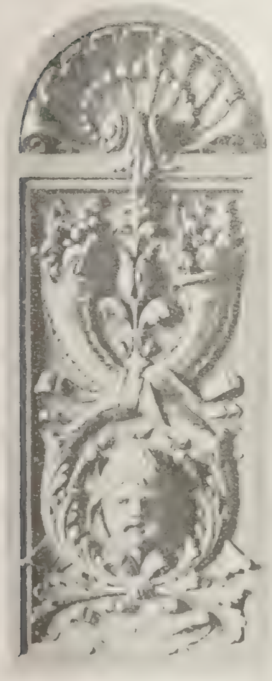
ST. FRANCIS DE SALES CHURCH, BROOKLYN, N. Y.
R. L. Daus, Architect.
The 500,000 old gold shade bricks used in the construction of this church were furnished by Meeker & Carter.

with the anticipated severity of the winter, will keep much of the more important work from being started before spring. But it seems to be the prevailing opinion that next year will be a good one in the building line.

PITTSBURG.— The plans for the proposed Carnegie Branch Libraries to be built in Lawrenceville, Hazelwood, East End, West End, South Side, and at Granville Street and Wylie Avenue have been completed, and are now in the hands of President W. W. Frew. They will be presented to the building committee within a short time.

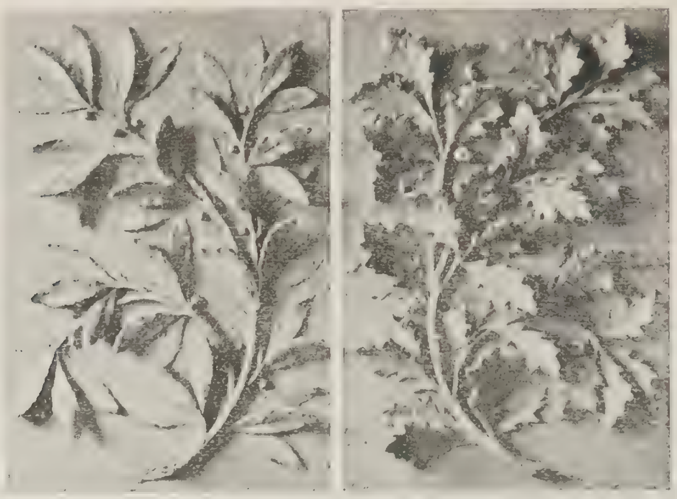
Capt. J. B. Ford, "the father of the American plate glass industry," is having plans prepared for a library, opera and club house for Ford City, to cost about $55,000.

The Fifth Avenue Baptist congregation of McKeesport will shortly begin the erection of a brick church, to cost $10.000. Architect T. D. Evans has prepared plans for a brick and stone Catholic Church building to be erected at Hazelwood. He is also preparing plans for a large warehouse building to be erected down town; slow-combustion principle. Architect Chauncey Hodgdon is preparing plans for a four-story brick and stone hotel at McDonald. Architect Fred Sauer has prepared plans for a five-story brick and stone stock and brew house for the F. L. Ober Brewing Company, at Allegheny. It is proposed to erect an apartment house on the site of the old school building at North Avenue and Palo Alto Street, Allegheny, to cost $300,000. Architect Charles Bickel has prepared plans for a two-story residence for James B. Haines, Esq., at Sewickley, to cost $30,000.



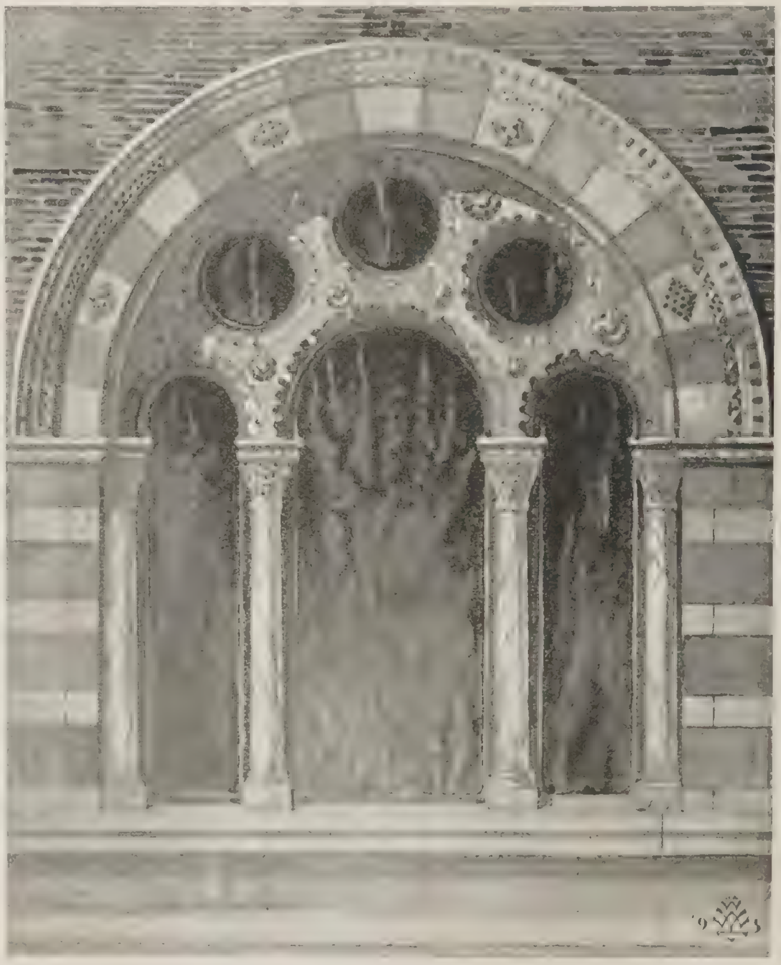
TERRA-COTTA PANEL, MAENNERCHOR HALL, PHILADELPHIA.
Made by Conkling-Armstrong Terra-Cotta Company.

MINNEAPOLIS.— Since my last letter, winter has come down upon us in earnest. A certain amount of work is going ahead regardless of the weather, and it is expected that a number of new buildings are to be commenced very soon. The low prices prevailing now and the certainty of advances all along the line by spring are the principal inducements. Money is now available for this work that could not be had under any consideration a month ago.



TERRA-COTTA PANEL, MAENNERCHOR HALL, PHILADELPHIA.
Made by Conkling-Armstrong Terra-Cotta Company.

There will probably be a strong effort made, during the coming



BYZANTINE TRACERIED WINDOW IN BUILDING AT 252 WEST 138TH STREET, NEW YORK CITY. SHOWING A COMBINATION IN BRICK, TERRA-COTTA, AND MARBLE.
Jardine, Kent & Jardine, Architects.

year, to complete the city side of our new Court House, involving an expense of over $300,000. Our city officials are badly cramped in their present unhealthy quarters, and it seems wrong to delay the completion of the new building when it is a mere matter of interior finish and furnishing.

TERRA-COTTA BALCONY CORBEL FOR C. WEYAND BREWING CO., BUFFALO, N. Y.
Geo. J. Metzger, Architect.
Made by the Northwestern Terra-Cotta Company.

Indications are growing for a good season next year, and we are all strong in hopes therefor.

In St. Paul the situation is pretty much the same as in Minneapolis. There is some new work, mostly of a small character. The new Northern Pacific Office Building is under roof, and work is being pushed on interior. This will be completed by February 1.

On the new Capitol Building, the foundation contract is practically completed, and indications point to a lively time in the coming session of legislature, looking to completion of the building in a reasonable length of time, instead of delaying it for years, and using the money as it comes in annually. It is proposed to borrow the necessary funds from the school or some other fund, and repaying it as the annual appropriations fall due. This would enable the commission to let contracts to advantage, and permit of the completion of the building in a year or so. The building is greatly needed, as the present structure is inadequate, and is also regarded as more or less unsafe for holding large sessions.

DETROIT.— Architects Donaldson & Meier have completed plans for a six-story business block for George W. and Octavia W. Bates, to be erected at the southwest corner of Woodward Avenue and Clifford Street. It will have a frontage of 60 ft. on Woodward Avenue, and 100 ft. on Clifford Street, and will be of modern steel-frame, fire-proof construction. The two fronts will be of mottled brown pressed brick with trimmings of Lake Superior brownstone and terra-cotta. It will be a purely commercial building, intended for one large mercantile concern, who will occupy it exclusively. The commencement of the structure will be delayed until a suitable tenant shall be secured, so that the interior arrangement and fittings may be suited to his requirements. The estimated cost of the building is $100,000.

The Detroit Light Infantry has adopted the plans of Architects Malcomson & Higginbotham for a handsome armory, which they will erect at the northwest corner of Brush and Larned Streets. It will have a frontage of 270 by 126 ft. in depth, and partly two and partly three stories in height. The fronts will be of pressed brick, terra-cotta, and Ohio sandstone, with metal and slate roof. The estimated cost is $60,000.

Architect William S. Joy is preparing plans for an apartment house, which is intended to eclipse anything of the kind heretofore attempted in this section. It will be 200 by 75 ft. in size, eight stories high, of fire-proof construction, and will cost $100,000. Its erection will be commenced early in the spring of 1897.

CORRESPONDENCE.

TO THE EDITOR OF THE BRICKBUILDER:—

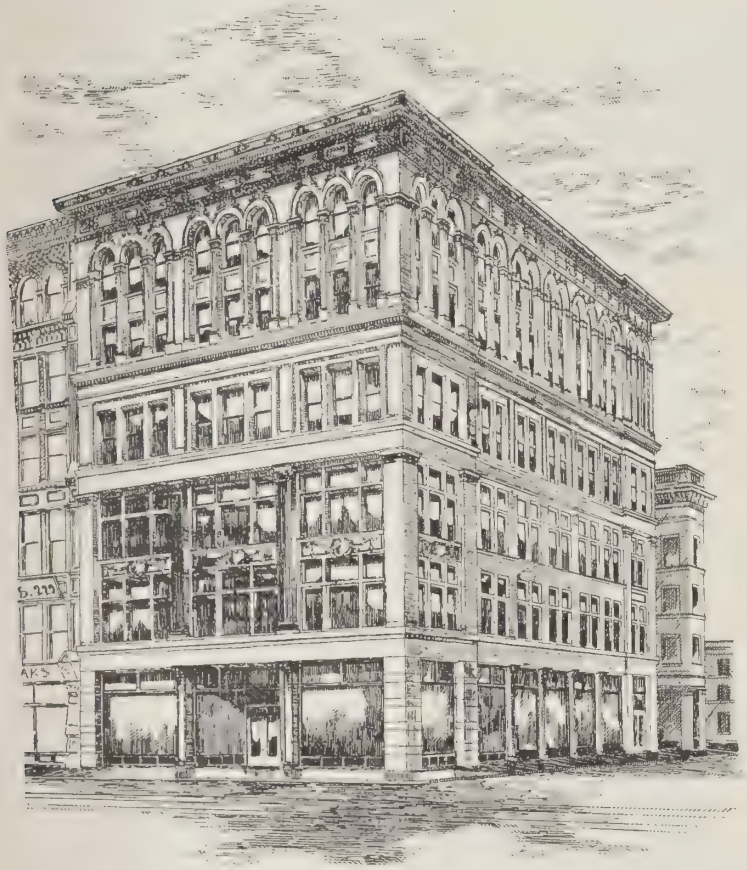
Referring to your leading editorial, in the November number, on the importance of terra-cotta manufacturers setting their own work, I think it should be set down to the credit of the Northwestern Terra-Cotta Company, of Chicago, the oldest factory in this country, that they have always included in their estimates the trimming and fitting of their material at the building at which it is to be used, and in every important contract insist upon setting their own work. I had always thought, until I read your article, that this custom was general with Eastern manufacturers. They still have one man in their employ who performed this kind of work before their time, for the old Chicago Terra-Cotta Works, and who is an expert in his line. I think they also set the pace for others in making it one principle of their management, in order to maintain the high artistic value of their products, that nothing but hand work should be done in their factory after the clay was prepared.

CHICAGO, Dec. 8, 1896. PETER B. WIGHT.

WE received recently a communication from one of our subscribers (architect) asking us to publish a description of the various kinds of cement, stating their properties, kinds of work to

TERRA-COTTA MANTEL FOR RESIDENCE OF C. W. C. DREXEL.
Peabody & Stearns, Architects.
Made by Perth Amboy Terra-Cotta Company.

which they are best adapted, quickness in setting, cost, etc. At the time of receiving this letter we had before us a circular, recently issued by Morris Ebert, Philadelphia, importer of the Mannheimer Portland cement. We print below Mr. Ebert's statement regarding the Mannheimer cement. It is our purpose to furnish in a later number data regarding other well-known brands of cement.



BATES BUILDING, DETROIT.
Donaldson & Meier, Architects.

"Mannheimer Portland cement is thoroughly reliable and dependable under all the varying conditions to which a Portland cement is subjected.

"Its chemical composition, as shown by analysis, proves it to be an artificial Portland cement of the highest grade.

"Its absolute uniformity is a guarantee of the great care taken in the perfect combination of the raw materials and the uniform and thorough burning to which they are later subjected.

"Its excessive fineness allows the largest admixture of sand and stone for mortar and concrete work, thereby reducing the cost, as the finer a cement is ground the more work it will perform.

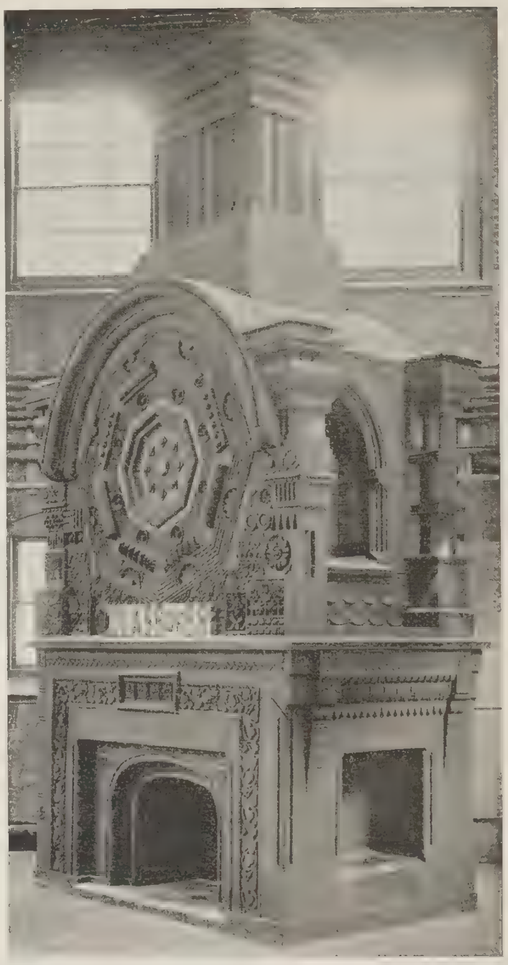
"It is high in tensile and compressive strength with a gradual increase for years. In this respect it differs from many brands of Portland cement, whose ultimate strength is reached in short periods.

"Mannheimer is particularly adapted for use in floors, pavements, roadways, and walks, as it resists abrasion and is not affected by exposure to the action of the elements.

"In mortar for brickwork and pointing, it is the most economical cement that can be obtained; it does not become short and reduces the percentage of waste to the minimum.

"For linings of cisterns and tanks and for all constructive work under water, it gives the best and most satisfactory results.

"It is well seasoned prior to shipment from the works, — a very important consideration in pavement and surface lining exposed to atmospheric changes where shrinking and cracking would result from the use of cement not thoroughly seasoned."



MANTEL BUILT BY THE CLASS OF 1896, AT WILLIAMSON FREE SCHOOL, PENNSYLVANIA. SHOWING MOLDED BRICKS MADE BY THE PEERLESS BRICK COMPANY, PHILADELPHIA.

CONOSERA tiles are so called from their shape, which is essentially a half cone, or conic section. Its shape gives it not only the greatest strength of any roofing tile made from burned clay, but also secures, by its mechanical accuracy, a perfect fit and weather-proof qualities possible with no other construction. Added to this is the fact that in artistic effect these tile are unequaled, owing to the beauty of their lines and mobility of their light and shadow effects; with Graduated Conosera any curved or tower surface can be covered

perfectly, with no break in the lines or danger of leaks. These shapes are made in the following sizes: 10 by 15 ins., 8 by 12 ins., and 6 ins., 5 ins., 4 ins., 3 ins., and 2 by 12 ins. The 10 in. is especially adapted for use on large buildings; the 8 in. on residences, and the others on curved surfaces. These tiles were placed on the residence of J. W. Kaufman, St. Louis, last summer, as shown in the accompanying cut. Here is what the architects and roofers say of them:—

Link & Rosenheim, Architects,
Union Trust Building,
St. Louis.

St. Louis, Mo., Sept. 21, 1896.

Mr. Charles T. Harris,
Lessee of Celadon Terra-Cotta Co.,
Alfred, N. Y.

Dear Sir:—Replying to your favor of the 15th inst. regarding the tile used by us upon the residence and coach house on Mr. John W. Kaufman's premises in this city, will say that the same are very satisfactory to us in every particular and we shall be very glad indeed to say a good word for them whenever occasion presents itself.

They are certainly artistic, and what is better still, make an absolutely tight roof, proof of which we have had in that there has been no leaks of any kind during the recent heavy rains we have had since the roof was completed.

Wishing you the best success, we are,

Yours very truly,
Dict. A. F. R. Link & Rosenheim.

HAYDEN SLATE COMPANY,
Slate and Tile Roofing.
Dealers in Roofing Slate and Tile.
Cor. Locust and Twelfth Streets,

St. Louis, Mo., July 25, 1896.

Charles T. Harris, Esq.,
Lessee Celadon Terra-Cotta Co.,
Alfred, N. Y.

Dear Sir:—Your favor of the 21st inst. regarding the roof of Mr. Kaufman's house received.

Mr. Kaufman's house was not directly in the path of the worst of the recent tornado. The storm, as near as we can make out from Weather Bureau reports, came from two directions, one from the northwest and the other from the southwest. It was after the two clouds united that the greatest damage was done in the southern portion of the city. However, a great deal of damage was done in the neighborhood of Kaufman's house, which was on the western edge of the northwest cloud, and as the house was not entirely finished at the time, we consider ourselves very lucky that the roof was left at all.

We have had constant and severe storms for the past two months and not a single leak has developed; so that as it regards the weather-proof qualities of your tile we feel safe in saying they are entirely satisfactory.*

This residence is at the entrance to the Park and on the most prominent residence corner in our city. The roof makes a grand appearance and will do you a world of good as an advertisement.

When you consider the difficulties we had in getting measurements for some of this work, without going to great expense for scaffolding, we feel that you will be gratified to hear that everything got out by you worked out nicely.

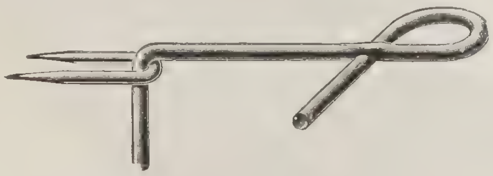
Yours respectfully,
Hayden Slate Co.

* N. B. This roof was laid without cement. C. T. H.

THE MORSE PATENT WALL AND VENEER TIES.

THE Morse Ties have been before the building trade for several seasons, and have been used in many of the most expensive and prominent structures. They have received unqualified approval from architects and builders alike, not only because they represent improved construction, but because they are economical, saving much labor and material. These are points which are particularly appreciated by builders—among whom they are constantly growing in popularity.

A new form of the tie recently introduced by the manufacturers is the Morse Patent Veneer Tie, shown below.



THE MORSE PATENT VENEER TIE.

This tie is rapidly growing in favor in those sections of the country where veneer construction is largely used. As readily seen, it forms a most substantial bond between the brick and woodwork, and is applied very quickly.

A new catalogue, fully explaining veneer construction, and containing other valuable data, will be mailed on application to the manufacturers, J. B. Prescott & Son, Webster, Mass.

WATCH THIS COLUMN FOR POINTERS.

The Fawcett System of Ventilated Fire-proofing will be used in the new St. James Building, corner of 26th Street and Broadway, New York City, for which Bruce Price is the architect, and J. E. & A. L. Pennock, of Philadelphia, contractors.

O. W. Peterson & Co., Boston, are supplying one hundred thousand red-face brick for the new schoolhouse, Dorchester district, Boston, A. Warren Gould, architect; Mack and Moore, contractors.

The Commercial Wood and Cement Company, 156 Fifth Avenue, New York, have closed a contract to furnish forty-six thousand barrels of Commercial Portland Cement on the Erie Canal Improvements that are being made this winter.

H. F. Mayland & Co., New York, have secured the contract for fifty thousand buff brick to be used in the St. Paul's Lutheran Church, Brooklyn, Theo. Engelhardt, architect. A brick made by the Brooke Terra-Cotta Co., Lazearville, W. Va., will be used.

Through their New York agents, H. F. Mayland & Co., 287 Fourth Avenue, the Fuller Brick & Slate Co., Pine Grove Furnace, Cumberland County, Penn., have closed a contract to supply four hundred thousand bricks for the new St. James Building, New York City, Bruce Price, architect.

The Donnelly Terra-Cotta Company has secured contracts for the terra-cotta work for St. Joseph's Roman Catholic Church, New Britain, Conn., Wm. H. Cadwell, architect, John Canfield, builder; and also for the Wallingford, Conn., High School, Wm. H. Allen, architect, New Haven, Lawrence O'Brien, builder.

Meeker & Carter have the contract for the bricks in the St. John's House, St. Mark Avenue, Brooklyn, R. L. Daus, architect, Thos. Carlin, builder. The main body of the building will be of dark gray brick with the receding courses of light gray. About 400,000 bricks will be used, same being made by the Ridgway Pressed Brick Company, Ridgway, Penn.

The Chambers Bros. Company, Philadelphia, have issued a pamphlet containing an illustration and description of their new Head Sanding and Brushing Machine, which is used in connection with the Chambers' Brick Machine for producing head sanded stretcher or stock brick. Other illustrations are of their self-contained, all iron and steel frame dry pan, and a large-sized "B. C. D" brick machine.

The non-staining qualities of Mereis Puzzolana cement secure a good sale for this brand. Waldo Brothers, the agents, report that it is being used at the Pope Building, Peabody & Stearns, architects; that it is specified for the Brazier Building, Cass Gilbert, architect, and many more important buildings. In spite of the high cost of this cement, the masons find that twice the quantity of sand can be carried than with Rosendale cement, and estimate the cost of laying bricks with Puzzolana cement at only about $1.50 per thousand in advance of Rosendale cement.

The Jarden Brick Company, of Philadelphia, extensive manufacturers of front brick, have entered into an agreement with the Powhatan Clay Manufacturing Company, whereby the latter firm will have the exclusive selling agency for the Jarden Company for the cities of New York and Brooklyn.

By the new arrangement the Powhatan Company will give their entire attention to the manufacture of cream-white bricks, while the Jarden Company will supply their regular line of front brick in all shades.

The New York offices of the Powhatan Company are located in the Mohawk Building, 160 Fifth Avenue. Mr. F. H. S. Morrison, who has managed the sales department of the company for the past year, will have the management of the new combination, assisted by an efficient corps of salesmen.

The Celadon Terra-Cotta Company, Charles T. Harris, Lessee, will furnish their roofing tiles for the following buildings: —

Residence for E. D. Ends, Hartford, Conn., Church of Our Lady, East Orange, N. J., O'Connor & Metcalf, architects. Residence for H. A. March, Kansas City, Mo., Frederick E. Hill, architect. Residence for Chas. L. Kurtz, Columbus, Ohio, Yost & Packard, architects. Eastern Ohio Insane Asylum, Massilon, Ohio, Yost & Packard, architects. Union Railway Station, Columbus, Ohio, D. H. Burnham & Co., architects. National Bank, East Orange, N. J., Ludlow & Valentine, architects. Woodlawn Memorial Chapel, Chicago, W. A. Otis, architect. St. Margaret's Memorial Hospital, Pittsburgh, Ernest Flagg, architect.

The New Jersey Terra-Cotta Company has lately received contracts for terra-cotta work for the following buildings: —

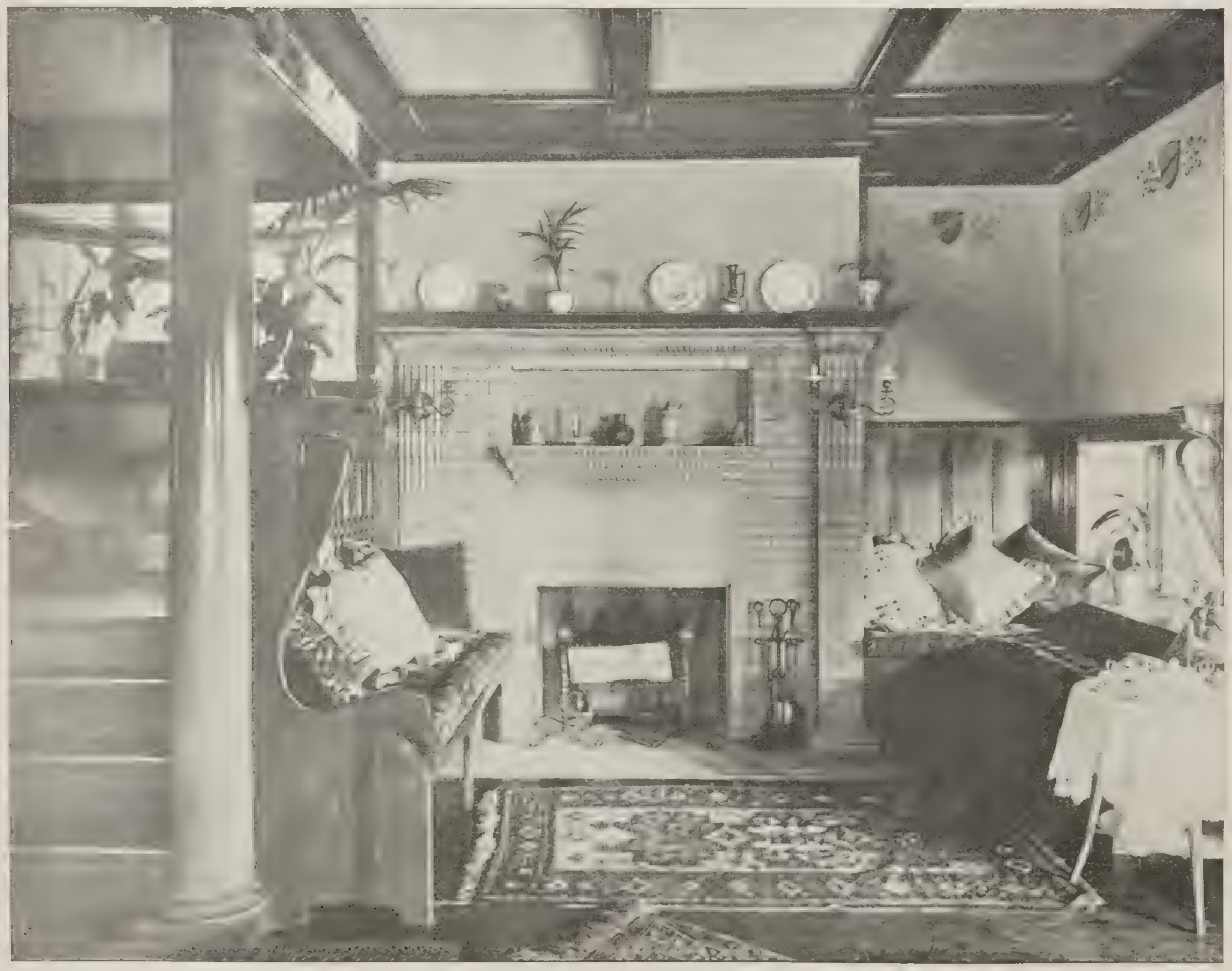
Ninth Precinct Police Station, New York City, John Du Fais, architect; Osterweiser Building, New Haven, Conn., Brunner & Tryon, architects; Y. M. C. A. Building, E. 87th Street, New York City, James E. Ware, architect; Mercantile Building, 38 Murray St., New York City, Robert Maynicke, architect; residence for James W. Quintard, Esq., Portchester, N. Y., M. C. Millen, architect; Storage Building, 260-266 West 36th St., New York City, Albert Wagner, architect; German Herald Building, Williams St., New York City, Louis Korn, architect; stores in Asbury Park, N. J., Cleverdon & Putzel, architects; Storage Building, 220-222 E. 126th St., New York City, John P. Walthers, architect.

The Columbus Brick and Terra-Cotta Company, works at Union Furnace, O., and offices at Columbus, have furnished their brick on the following contracts: —

New York Savings Bank Building, 14th Street and Eighth Avenue, N. Y., R. H. Robertson, architect (light buff standards). Grammar School No. 37, 87th Street, between Lexington and Fourth Avenues, New York City, C. B. J. Snyder, architect. Kirk-Christy Building, Cleveland, O. (speckled standards). Case Building, Detroit, Mich. (light gray standards). Wheelmen's Club, Detroit, Mich. (gray Romans). Residence for Mrs. John Owen, Jefferson Avenue, Owen Park, Detroit, Mich., Rogers & McFarlane, architects (terra-cotta standards). Residence for Mr. Prentiss, Palmer Avenue, Detroit, Mich., Rogers & McFarlane, architects (terra-cotta standards). Stevenson Building, Indianapolis, Ind., Henry Ives Cobb, architect (dark gray standards). Residence for Mr. Dickens, Milwaukee, Wis. Crane & Barkhouser, architects (terra-cotta standards). Knollenberg Building, Richmond, Ind., Jno. A. Hasecoster, architect (gray standards). Baptist Church, Delaware, O., C. A. Neff, architect (gray and terra-cotta standards). Court Exchange, Bridgeport, Conn., C. P. H. Gilbert, architect, New York City (light gray standards). Masonic Home, Lynchburg, Va. (light buff standards). Government Building, South Bend, Ind., (dark gray standards). Water Tower, Blind Asylum, Columbus, O. (dark buff standards and light buff).

WANTED.

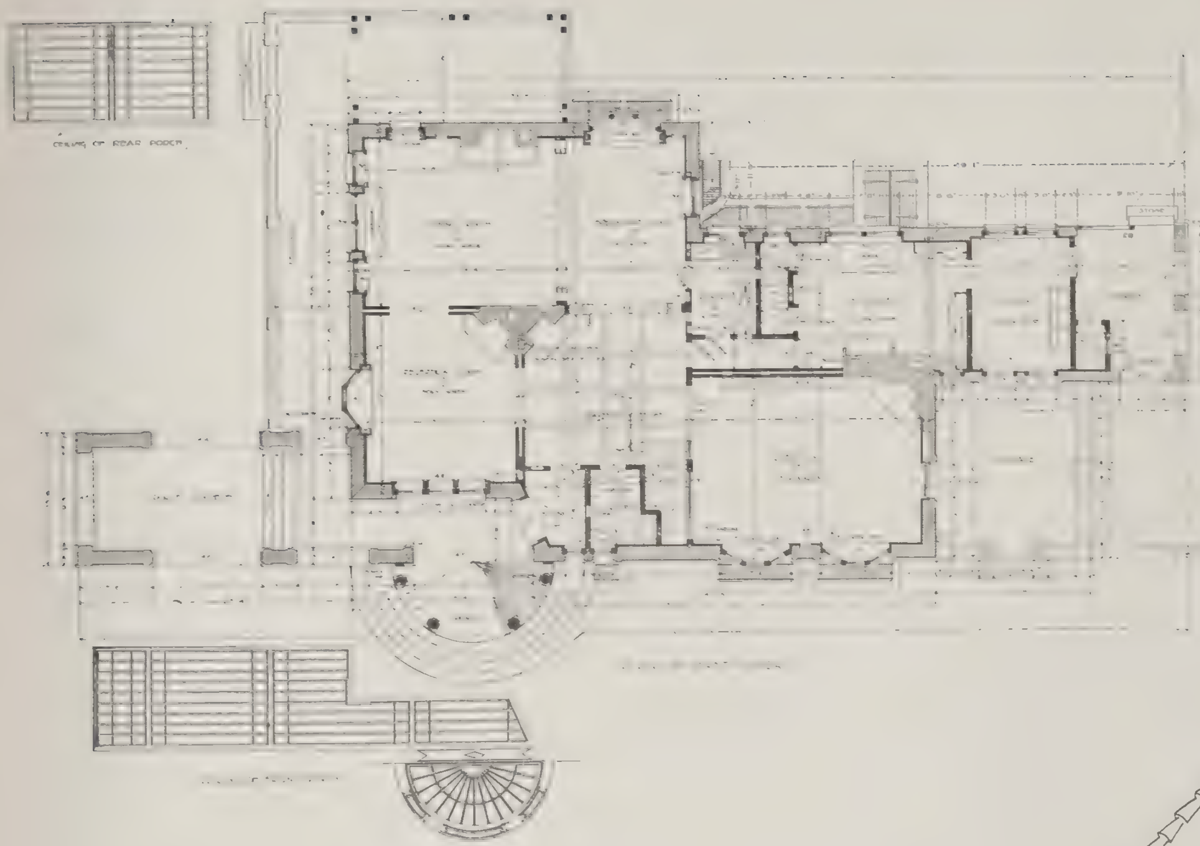
Energetic, educated, and experienced man (pressed brick salesman, draughtsman, or builder preferred) to introduce and sell Clay Products and Building Materials, in Ohio. Address, B. M. S. Co., care of this office.

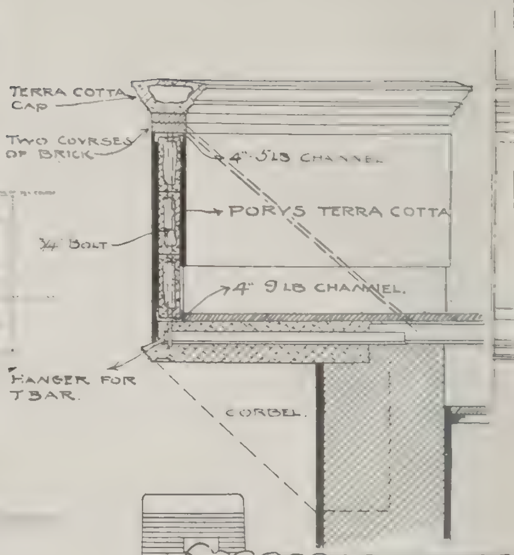


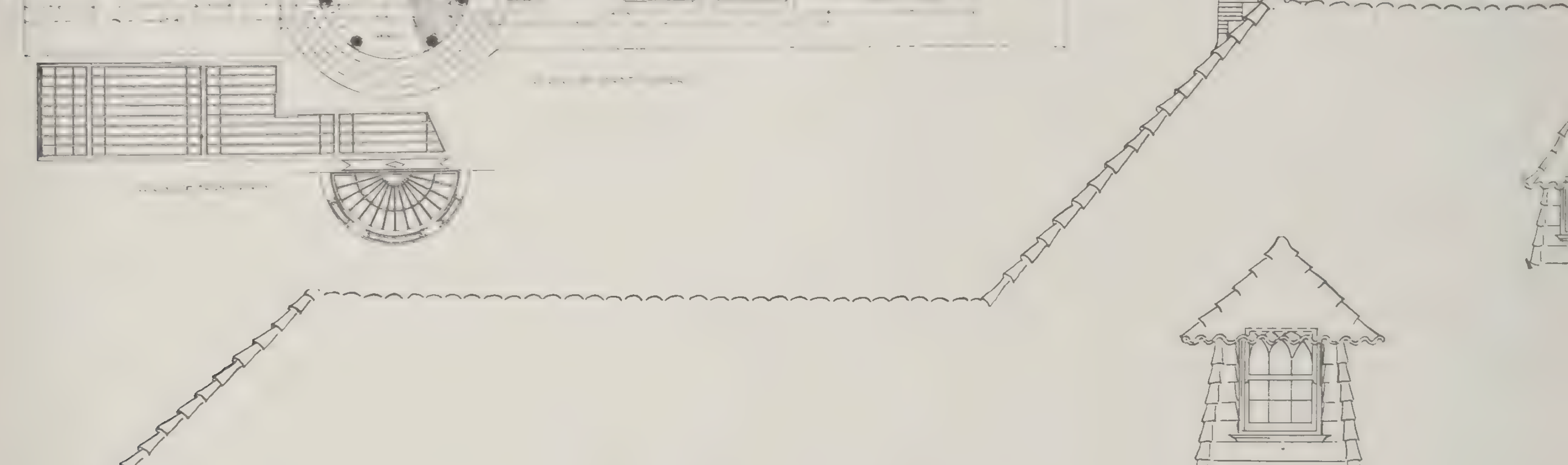
A FIREPLACE MANTEL MADE OF ORNAMENTAL UNGLAZED BRICK.

This was designed by the PHILADELPHIA & BOSTON FACE BRICK CO., of 15 Liberty Square, Boston, Mass. Their Sketch Book contains 52 designs costing from $12 upwards. Write them for one.

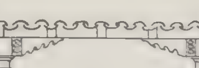
VOL. 5. NO. 12.







FRONT · ELEV



SOFFIT OF BALCONY

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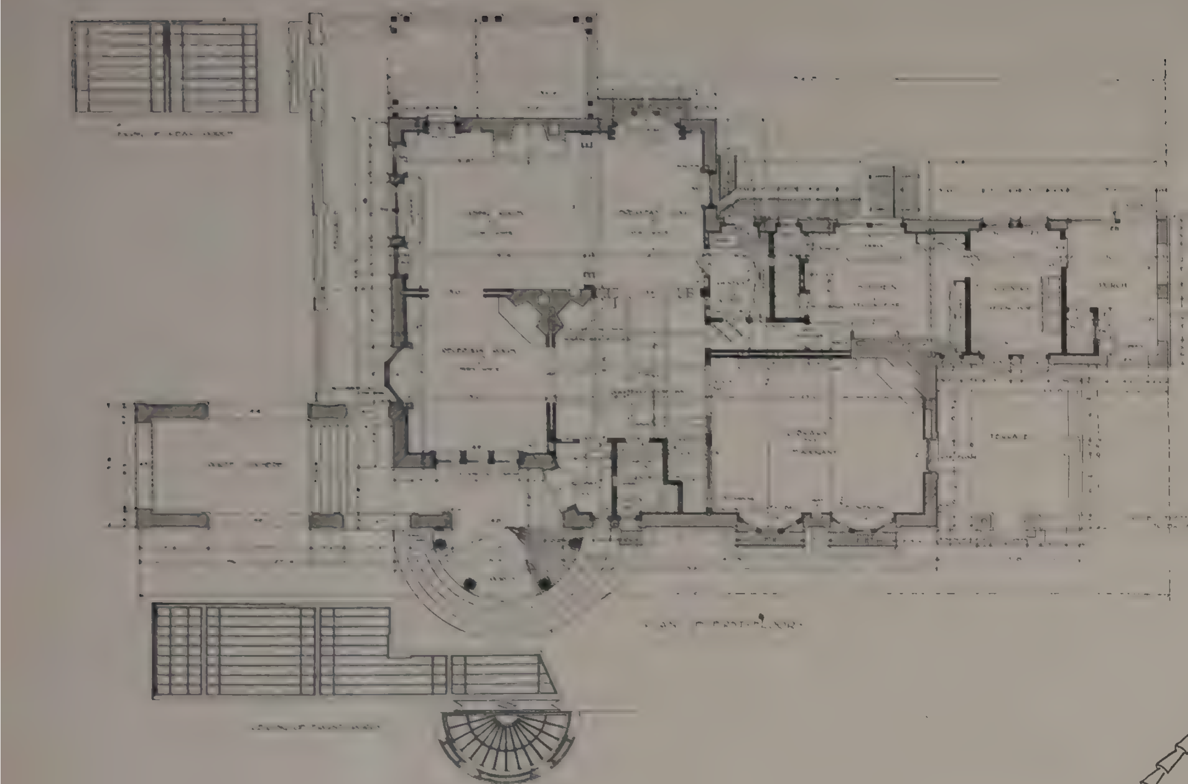
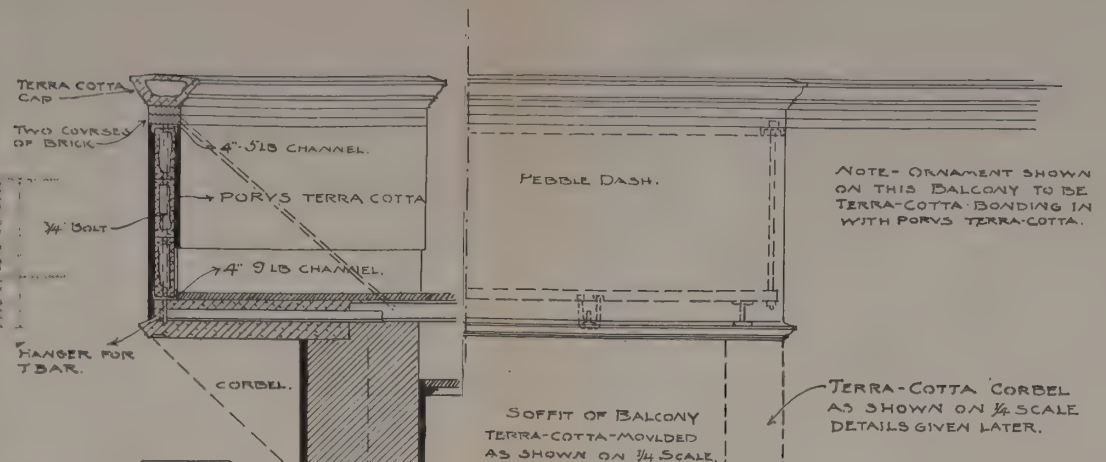
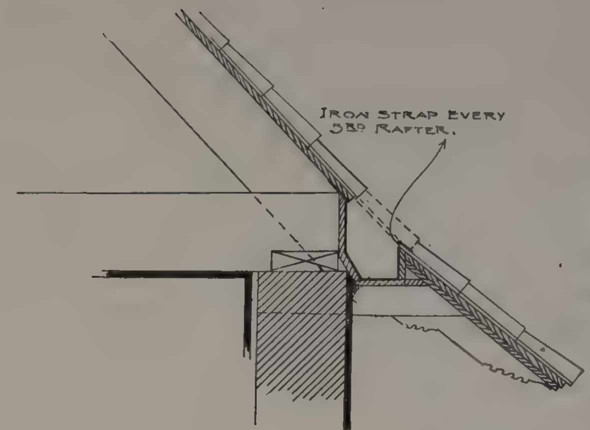
HOUSE FOR H. K. CUM

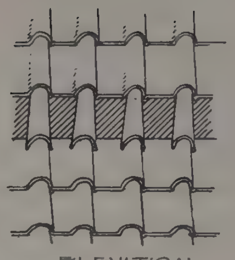
FRANK MILES



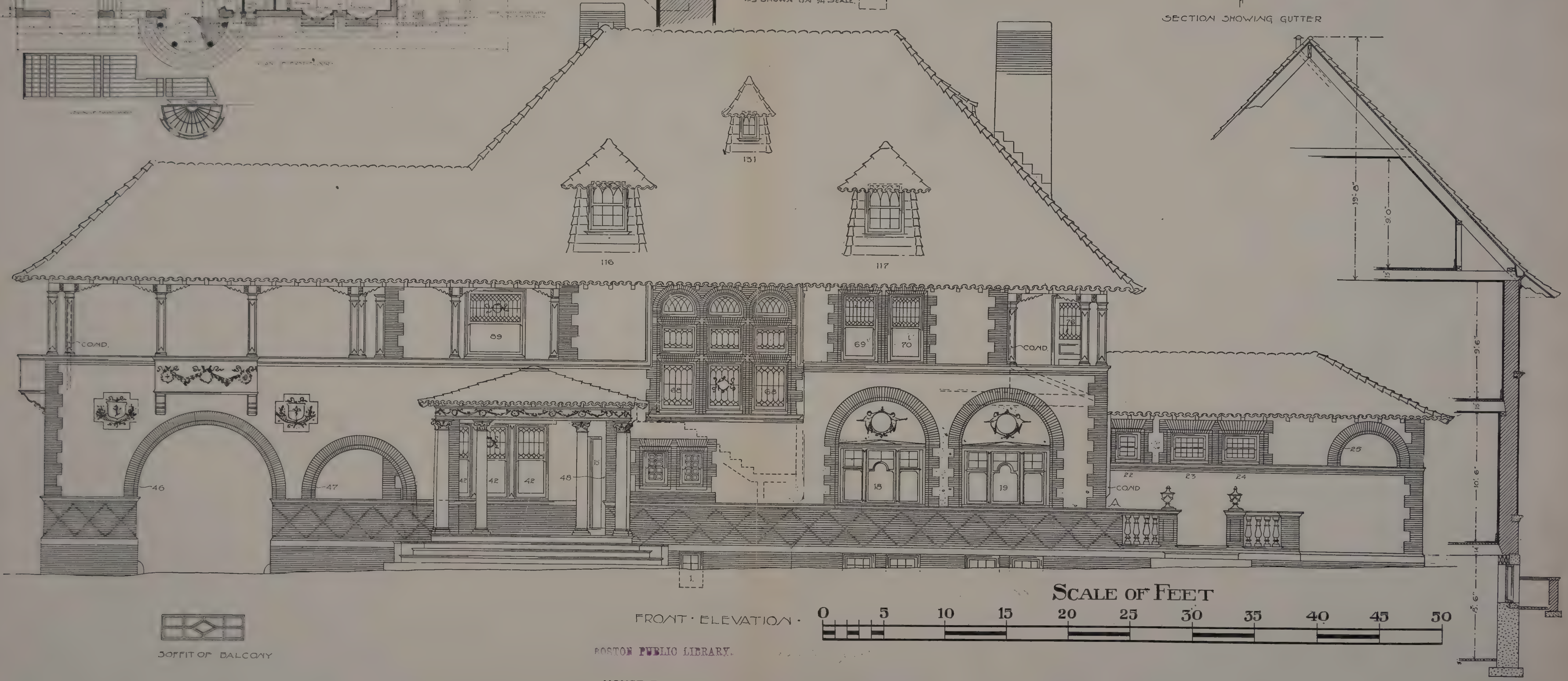

TERRA COTTA CAP
TWO COURSES OF BRICK
4" 5 LB CHANNEL
PORUS TERRA COTTA
¾" BOLT
4" 9 LB CHANNEL
HANGER FOR T BAR.
CORBEL.
PEBBLE DASH.
NOTE - ORNAMENT SHOWN ON THIS BALCONY TO BE TERRA-COTTA BONDING IN WITH PORUS TERRA-COTTA.
SOFFIT OF BALCONY TERRA-COTTA-MOULDED AS SHOWN ON ¼ SCALE.
TERRA-COTTA CORBEL AS SHOWN ON ¼ SCALE DETAILS GIVEN LATER.



SECTION SHOWING GUTTER



ELEVATION



SCALE OF FEET

FRONT · ELEVATION ·

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FRANK MILES DAY & BRO., Architects.

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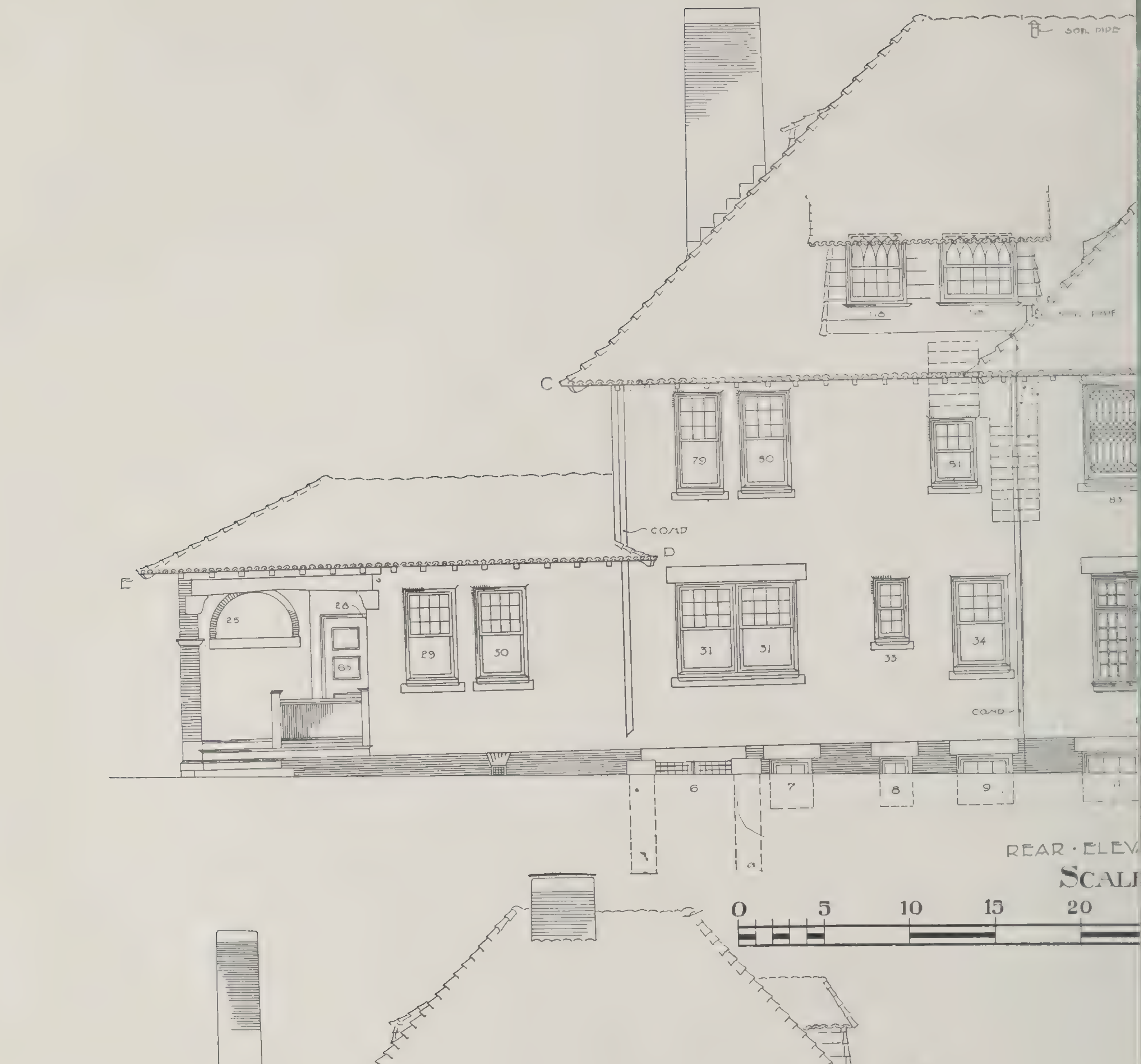

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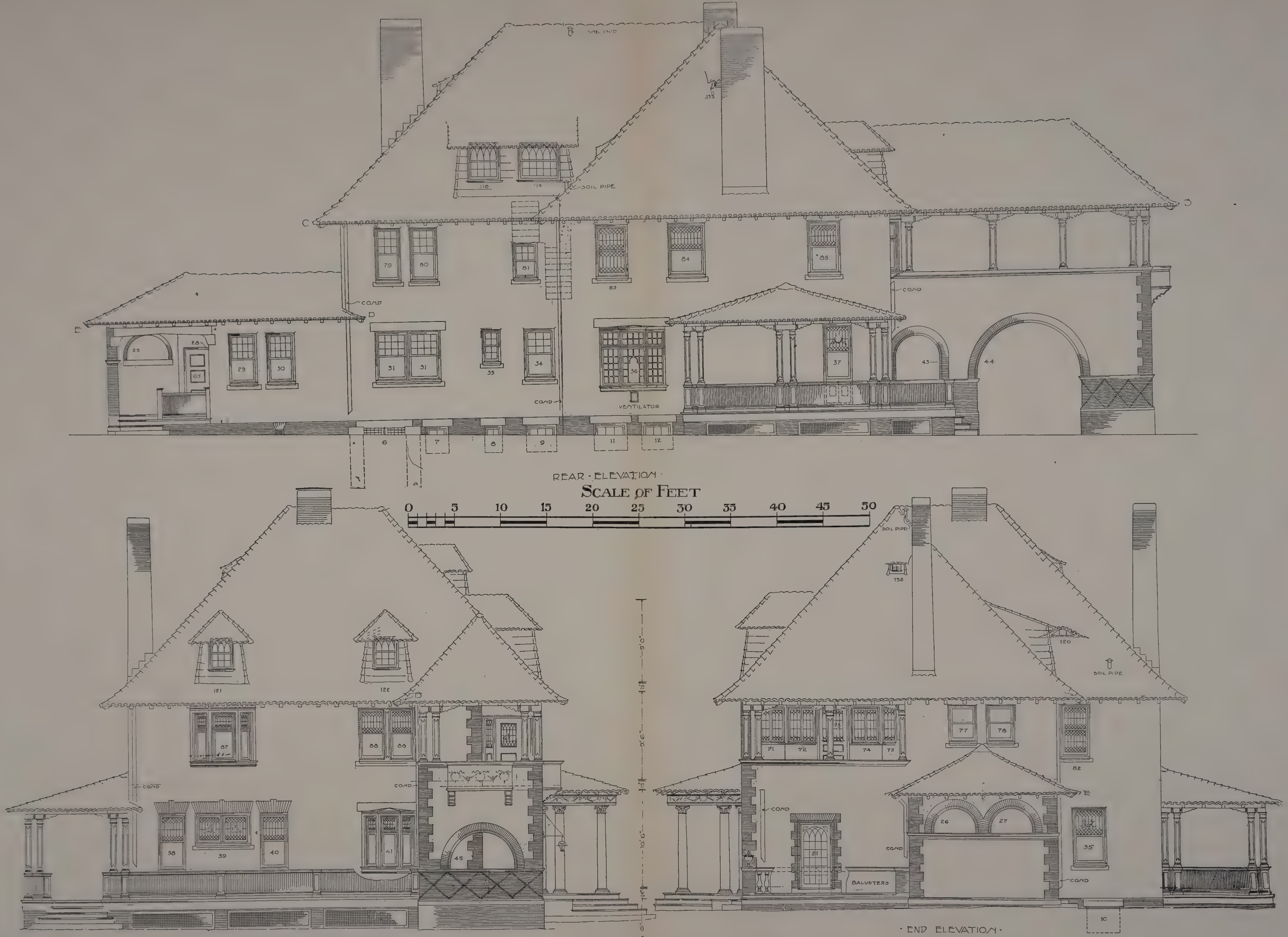

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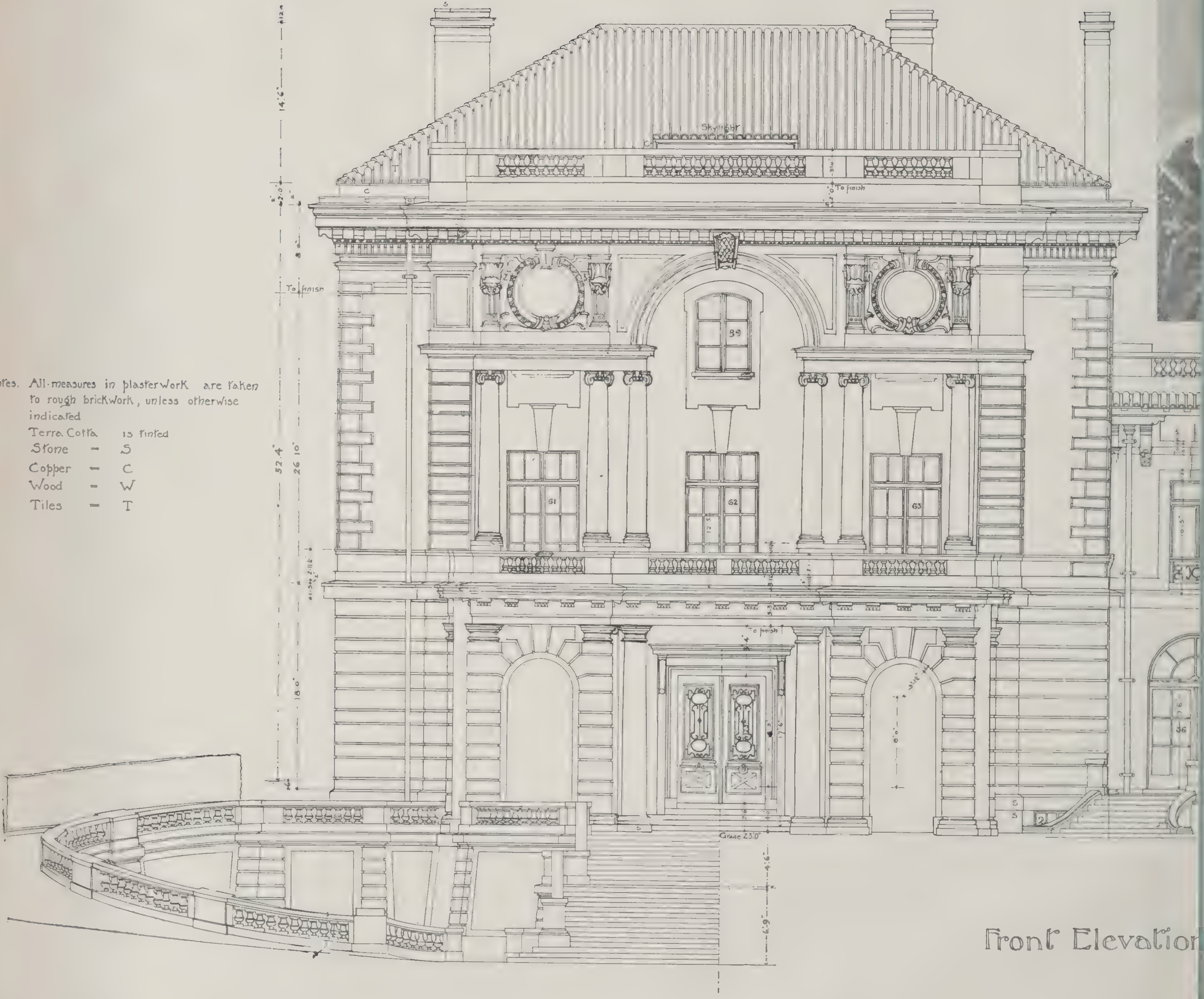
FRANK MILES DAY & BRO, Architects.

VOL. 5. NO. 12.

Notes. All measures in plasterwork are taken to rough brickwork, unless otherwise indicated

Terra Cotta	is tinted	
Stone	–	S
Copper	–	C
Wood	–	W
Tiles	–	T



Front Elevation

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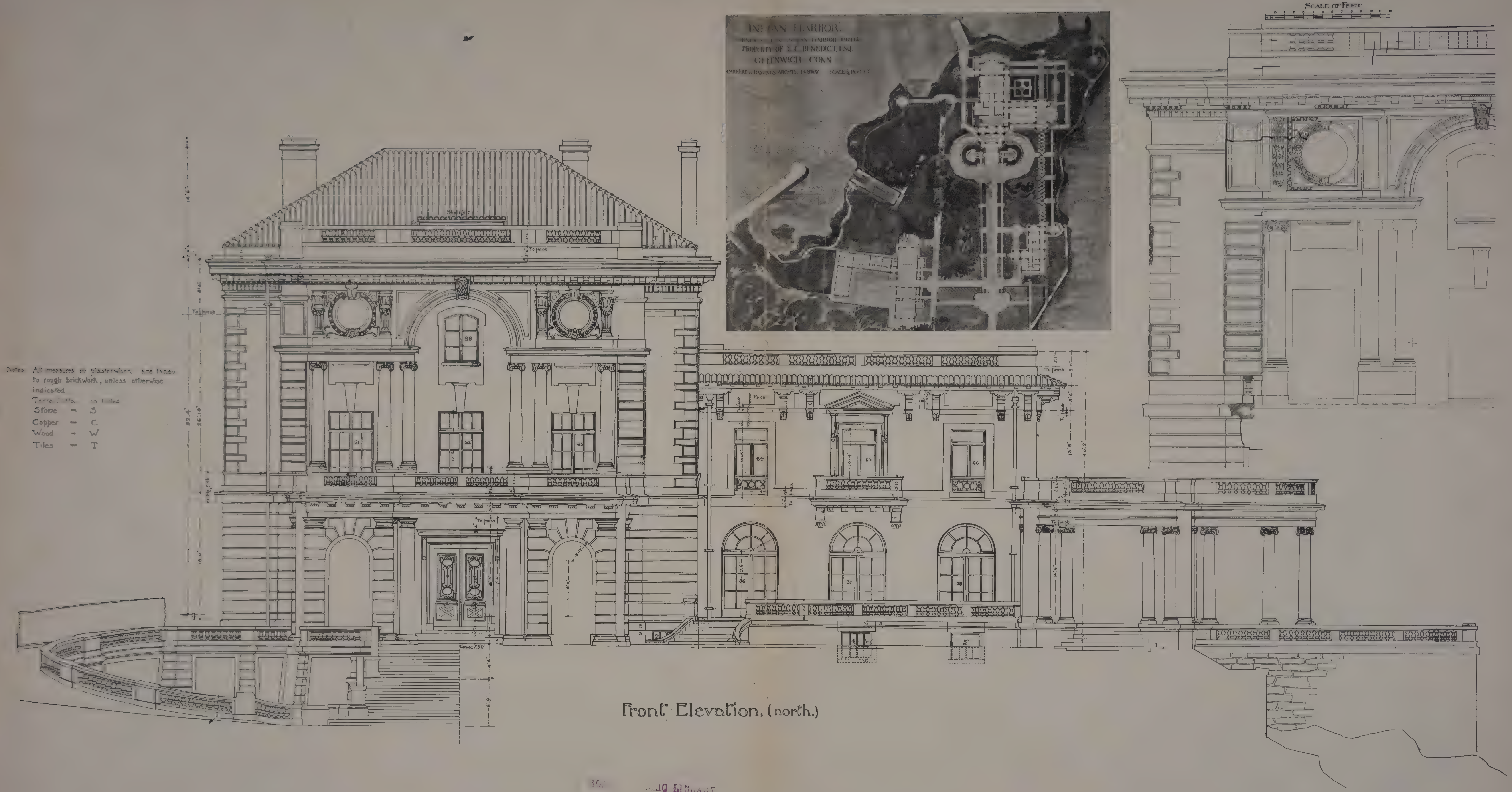
CARRERE & HA

THE BRICKBUILDER.

VOL. 5. NO. 12. PLATES 75 and 76.


INDIAN HARBOR.
FORMER SITE OF INDIAN HARBOR HOTEL
PROPERTY OF E. C. BENEDICT, ESQ.
GREENWICH, CONN.
CARRERE & HASTINGS ARCHTS. 14 B'WAY SCALE $\frac{1}{16}$ IN = 1 FT
SCALE OF FEET
Notes All measures in plasterwork are taken to rough brickwork, unless otherwise indicated
Terra Cotta is tinted
Stone = S
Copper = C
Wood = W
Tiles = T
To finish
52.4"
26.10"
59
61
62
63
64
65
66
36
37
38
Grade 23.0"

Front Elevation, (north.)

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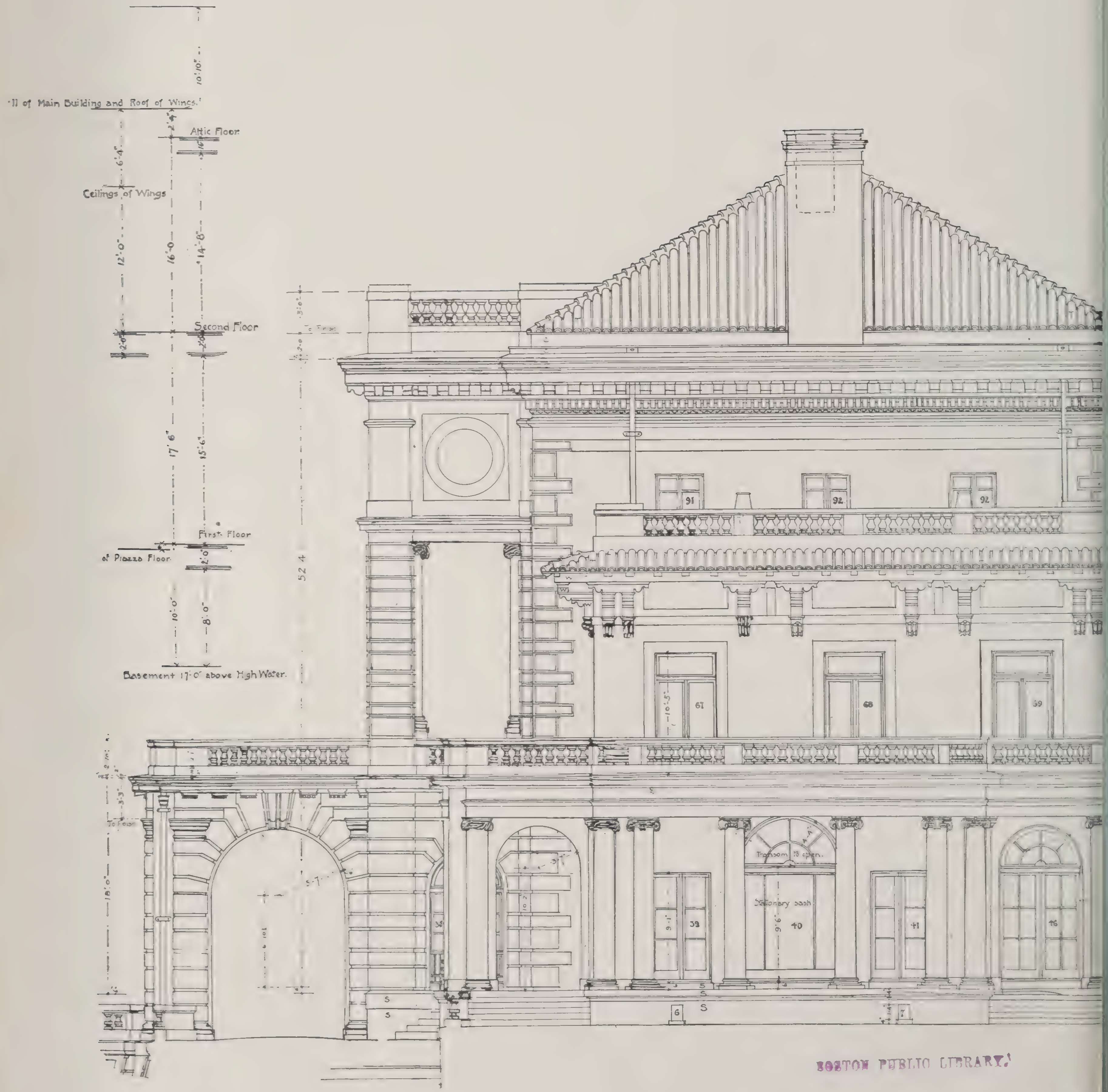
CARRERE & HASTINGS, Architects.



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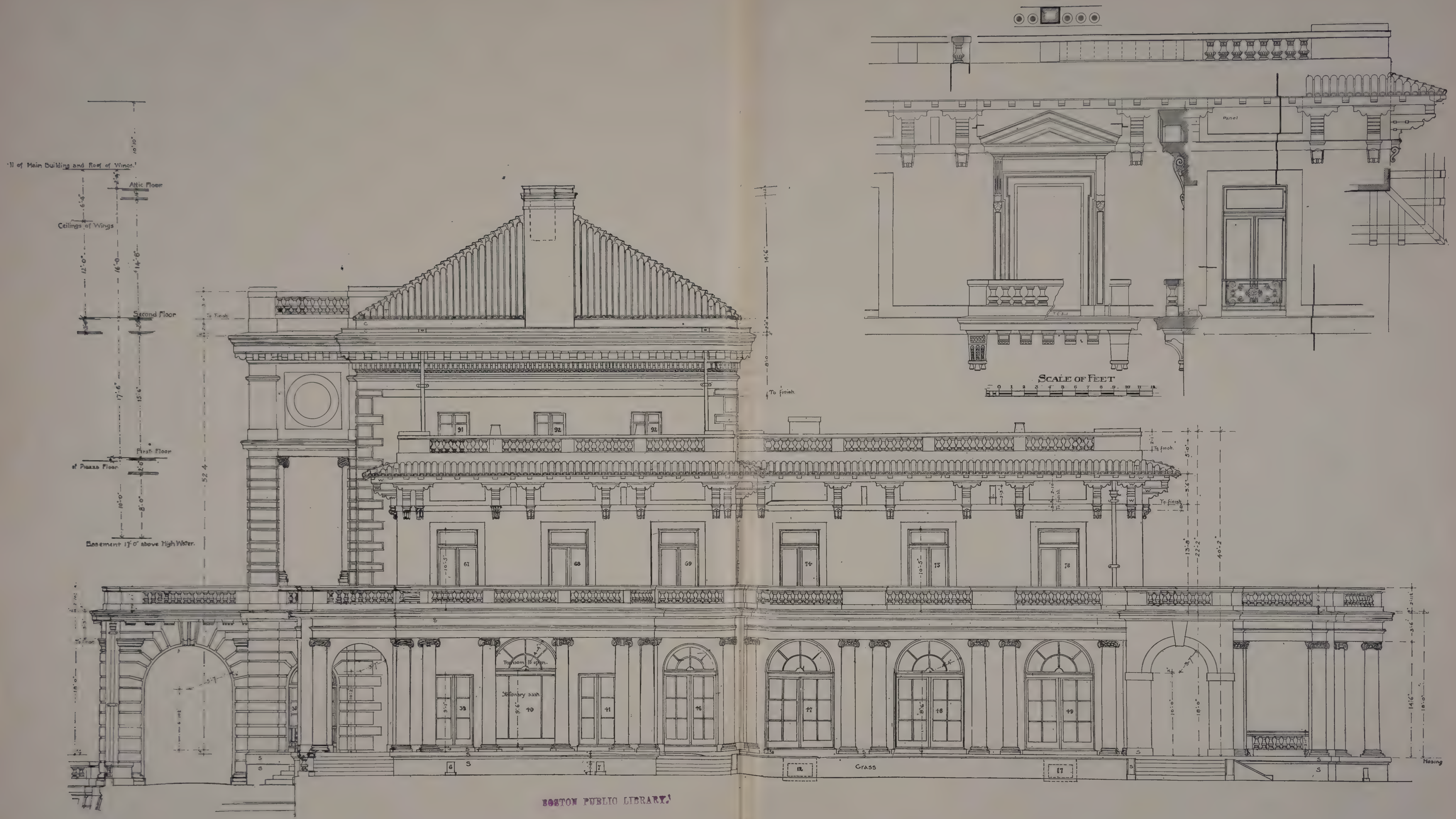

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WHITE, CREAM WHITE, BUFF (Light and Dark Shades), OCHRE, RED, GRAY (Light and Dark Shades), OLD GOLD, MOTTLED (or Pompeian), BOTH PLAIN AND MOLDED.

Enameled Brick, All Colors of Superior Quality.

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Sole Manufacturers of the

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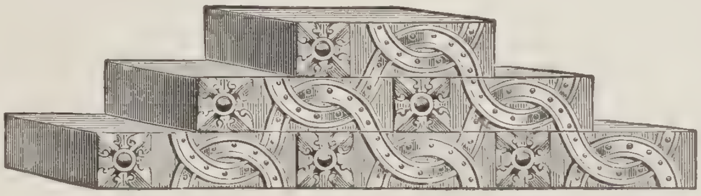

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"Peerless" Molded and Ornamental Bricks,

IN ALL COLORS.

Bricks ground and fitted for arches of all kinds promptly and satisfactorily.

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FIRE CLAY, ETC.

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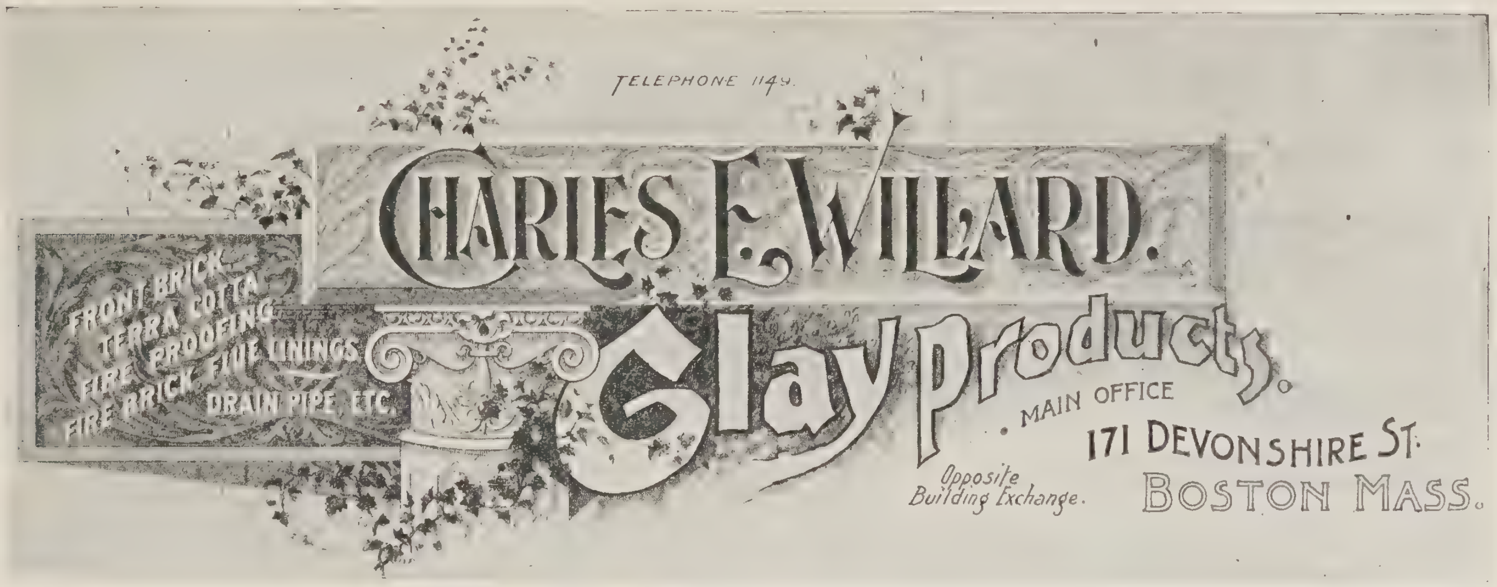
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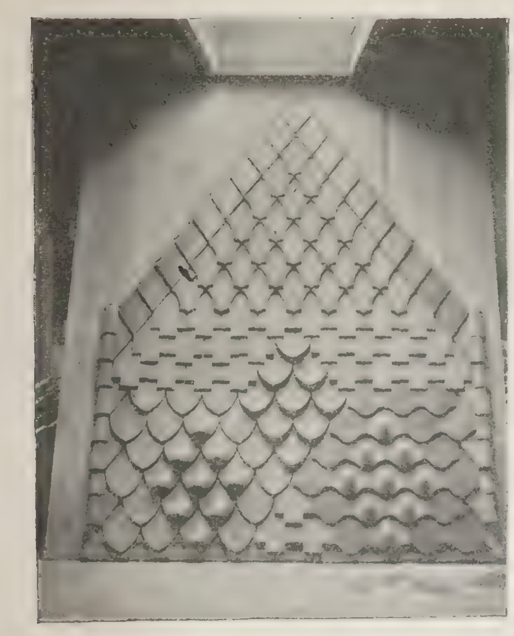

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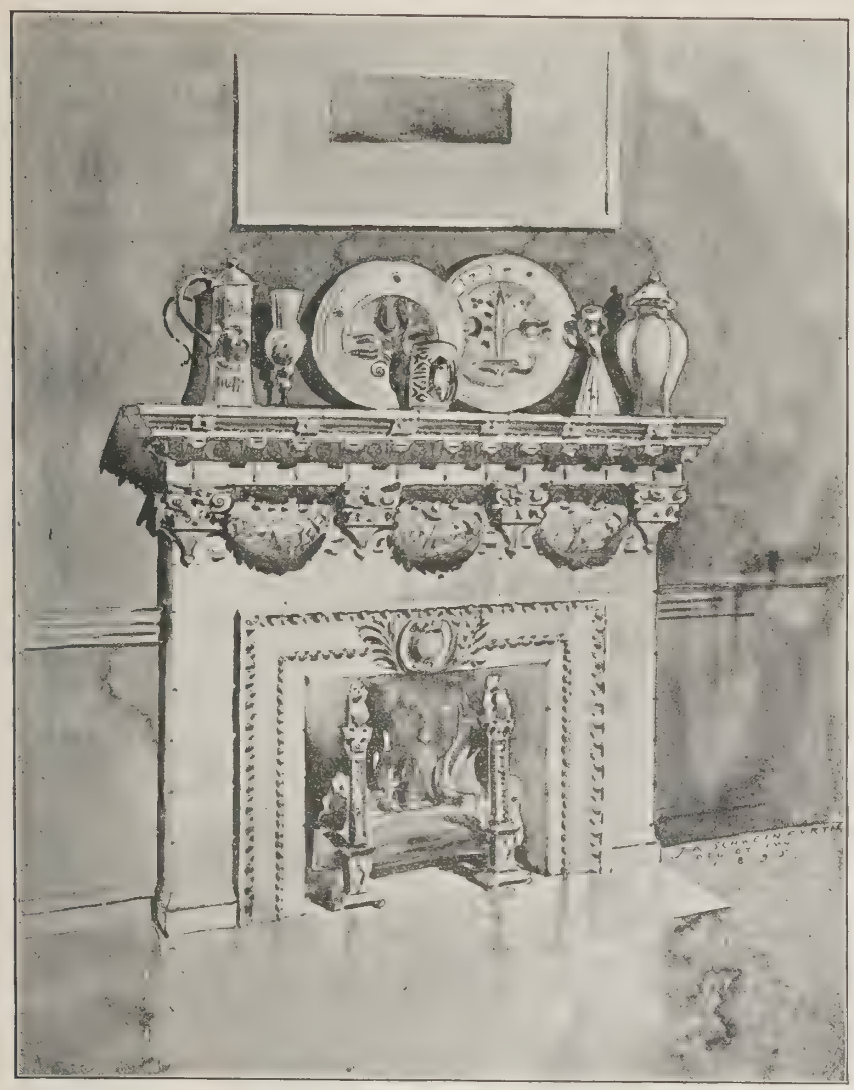

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7 days' average	541.6 (28 briquettes)	156.7 (28 briquettes)	91.8 (85 briquettes)	51.3 (28 briquettes)
28 days' average	726.1 (28 briquettes)	271.6 (28 briquettes)	185.1 (83 briquettes)	135.2 (28 briquettes)
3 months' average	805.0 (14 briquettes)	356.7 (14 briquettes)	269.1 (42 briquettes)	180.5 (14 briquettes)
6 months' average	829.0 (7 briquettes)	390.8 (7 briquettes)	272.4 (21 briquettes)	220.2 (7 briquettes)
1 year's average	797.5 (7 briquettes)	398.8 (7 briquettes)	316.0 (21 briquettes)	229.3 (6 briquettes)

The above 503 briquettes were made from samples drawn from 252 separate barrels, out of 18,500 barrels of "ALPHA" Portland Cement. Such results were never equaled for .....Strength, Uniformity, and Sand-Carrying Capacity.

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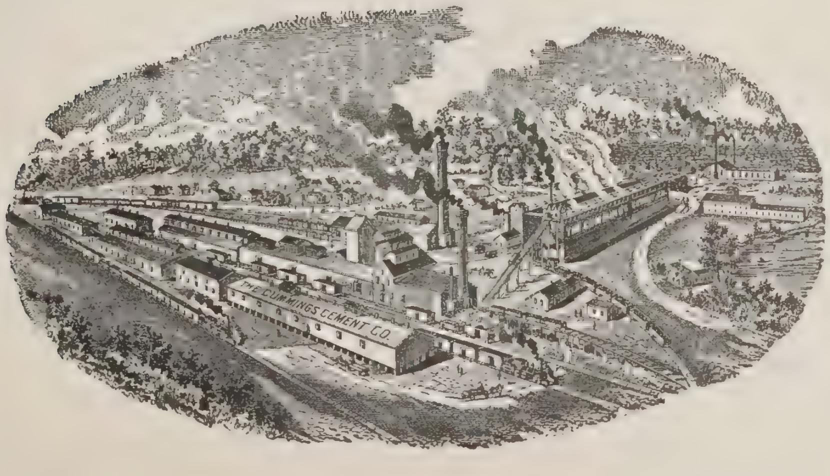
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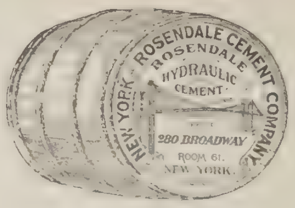

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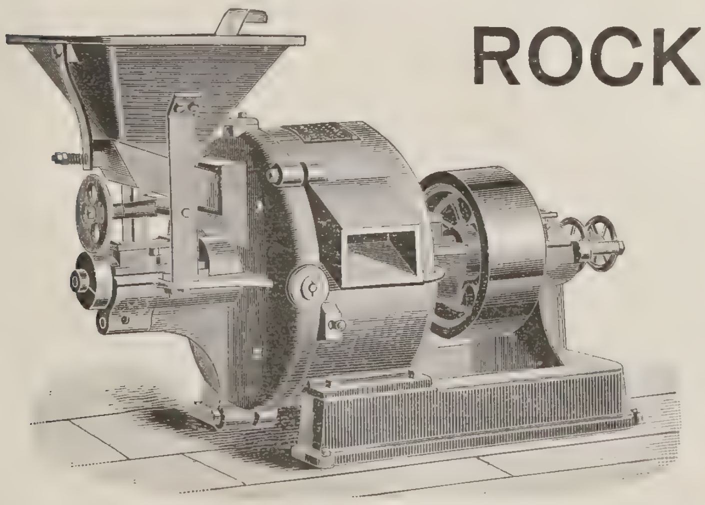

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Fourth. How many more bricks can a man lay when the wall is 2′ 0′ above where he stands than when it is 4′ 0″?	*Fourth.* How many more bricks will he lay if the wall is always about 2′ 0″ above where he stands?
Fifth. How many more bricks can a man lay when he is backing up the further 4″ the full thickness of the wall than when he is backing up 4″ for the next header on the further side of the wall?	*Fifth.* With this scaffold the bricklayer builds the further 4″ header high only, and then *backs up the full width of the wall*, the platforms, stock, workmen, and all, are jacked up and the same is repeated until the wall is completed.
Sixth. How many more brick will each man lay by having no brick under foot and by having the tenders out of his way?	*Sixth.* The bricklayers and tenders have entirely separate platforms.
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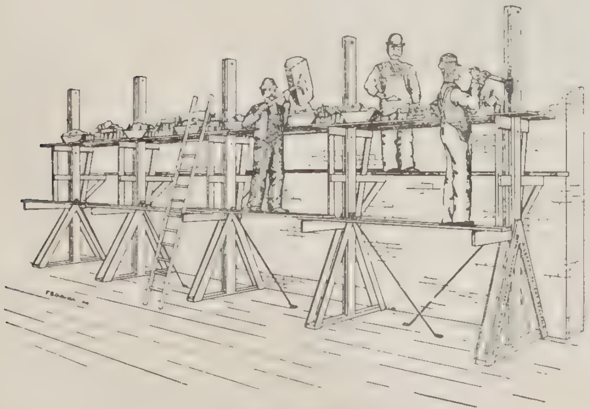

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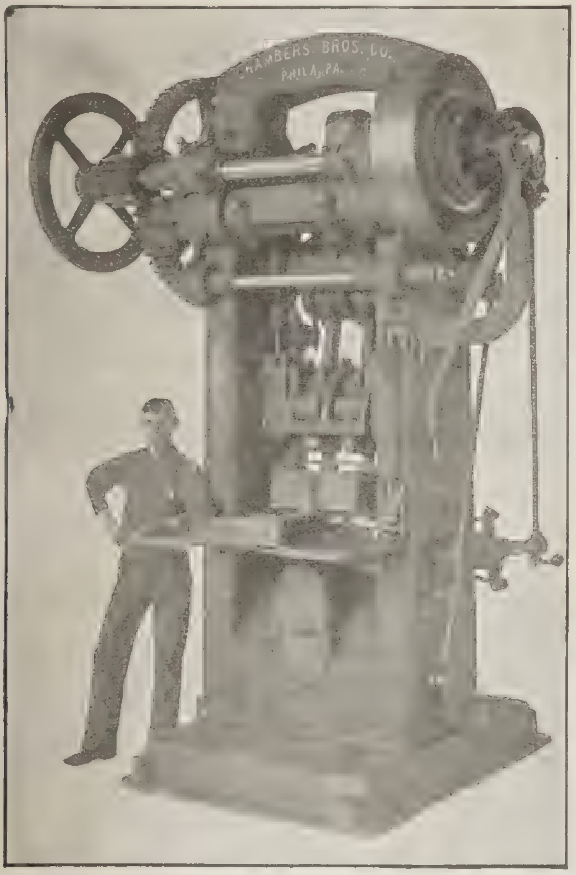

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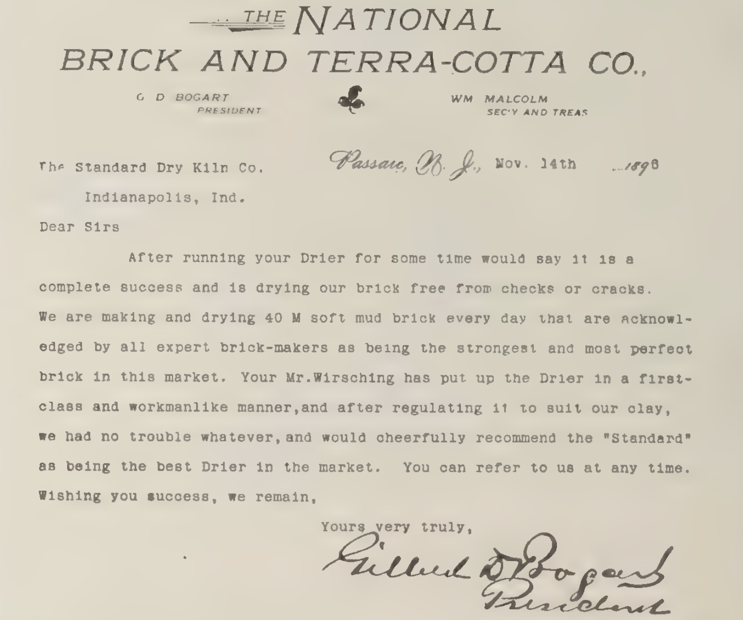

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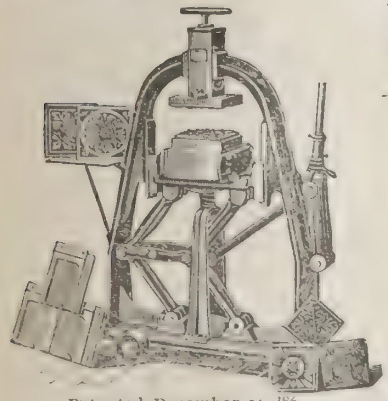

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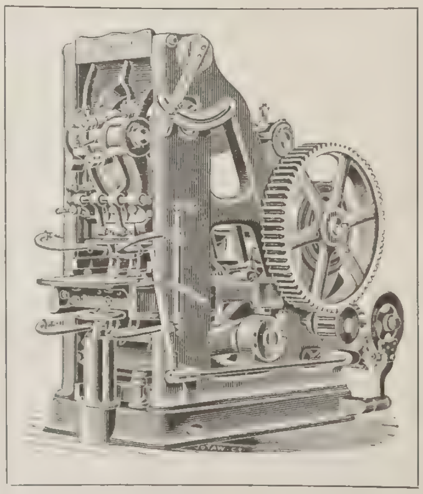

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WORKS AT BUCYRUS AND WILLOUGHBY.

The Brickbuilder for 1897.

Prospectus.

SCALE DRAWINGS.

OUR plate form of Scale Drawings, which will consist of at least eight plates each month, will be of unusual interest and value. We already have in hand, or in course of preparation, drawings from the offices of many of the leading architects of the country, and it may be safely said that the improvement which will be shown in this department will be among the marked features of our work for the year. One special feature in connection with this department will be the publishing of (in one number) the scale drawings of the University of Virginia Buildings, McKim, Mead & White, architects. There will be four plates from these drawings, each measuring 38 x 11 ins.,—the equivalent of sixteen regular size plates. Several other sets of drawings of important work will be given an additional number of plates.

MEASURED DRAWINGS OF FOREIGN WORK.

By the increase in the plate form we shall be enabled to print during the year a greater number of Measured Drawings of Foreign Work. These drawings are principally of Details, and are the work of

WALTER KILHAM, Rotch Scholar.
WILL S. ALDRICH, Rotch Scholar.
JAMES P. JAMIESON, University of Pennsylvania Scholar.
GEORGE OAKLEY TOTTEN, Jr., McKim Traveling Fellow.
C. H. ALDEN.

WRITERS WHO WILL CONTRIBUTE DURING THE YEAR.

Our letter-press form will contain articles on various subjects relating to architecture that cannot fail to be alike interesting and instructive. The contributions to this department for the year will furnish a most valuable series to current literature on the subject of architecture. Among our contributors will be:—

ROBERT D. ANDREWS,
CLARENCE H. BLACKALL,
WALTER COPE,
RALPH ADAMS CRAM,
WILLIAM W. CREHORE,
CHARLES A. CUMMINGS,
(President Boston Society of Architects.)
THOMAS CUSACK,
FRANK MILES DAY,
ERNEST FLAGG,
THOMAS A. FOX,
ELMER E. GARNSEY,
BERTRAM G. GOODHUE,
D. A. GREGG,
W. P. P. LONGFELLOW,
GEORGE F. NEWTON,
R. CLIPSTON STURGIS,
C. HOWARD WALKER,
J. HOLLIS WELLS,
EDMUND M. WHEELWRIGHT,
PETER B. WIGHT.

LEADING ARTICLES FOR THE YEAR.

Among the leading articles which will be published during the year may be mentioned

Schoolhouse Architecture.

By EDMUND M. WHEELWRIGHT.

In the discussion of this subject, Mr. Wheelwright will make comparison between the best German, French, and American methods of planning and construction, adding thereto a most interesting series of illustrations.

The Use of Brick in Suburban Architecture.

By R. CLIPSTON STURGIS.

These articles will be illustrated from Mr. Sturgis's own collection of drawings and photographs.

Color as Applied to Architecture.

By ELMER E. GARNSEY.

Mr. Garnsey, who has made a specialty of this line of work, will spend the coming year in Europe studying the best examples of the use of color in architecture; and during his travels will contribute to our columns several articles on this most important subject.

The Brick Architecture of Italy

will be the basis of a series of articles which will be contributed by Messrs. Cummings, Day, and Longfellow. The illustrations which will be given in connection with these articles will comprise many that have never before been published.

The Duties of the Architect in Connection with Landscape Architecture

is the subject chosen for treatment By WALTER COPE.

LEADING ARTICLES FOR THE YEAR.

Brick Vaults Built without Centers. (Illustrated)

Translated from the "Anales de la Construction y de la Industria" (two numbers)

By A. C. MUÑOZ.

Some Important Problems in Construction By WM. W. CREHORE, Asso. M. Am. Soc. C. E.

The other writers mentioned will contribute one or more articles each on subjects that will be announced later.

CONTINUED ARTICLES FROM 1896.

There remains to be printed, portions of series that were begun during the present year. These consist of

Spanish Brickwork (two numbers),	By C. H. BLACKALL.
Italian Brick Towers (two numbers),	By C. HOWARD WALKER.
Pen and Ink Rendering (probably two numbers),	By D. A. GREGG.
Architectural Terra-Cotta,	By THOMAS CUSACK.

Mr. Cusack will continue his present series of articles during the year, commencing at an early date with the first chapter of part second. He will elucidate current problems in terra-cotta making from the manufacturer's point of view, and in a way that cannot fail to be interesting and instructive to architects and others, many of whom have expressed a desire for reliable and really practical information of this character. The jointing and construction of columns; the security of balconies and balustrades, and approved methods of introducing iron support to cornices, and other projecting features, will be unreservedly discussed and illustrated by a complete set of working details and diagrams. In a word, it is Mr. Cusack's intention to treat these and kindred subjects in a most thorough and comprehensive manner.

SPECIAL DEPARTMENTS.

Our special departments devoted to the interests of

Fire-proofing, Mortars and Concrete, The Mason,
Recent Brick and Terra-Cotta Work in American Cities, and
Manufacturers' Department,

will be conducted in a manner to meet the approval of our subscribers.

It is our purpose to have these departments assume the character of independent periodicals, and to accomplish this every effort will be made to increase their usefulness and value.

Mr. Clifford Richardson, a prominent authority on cements, will contribute a number of articles embodying the results of a series of experiments extending over the past ten years with both natural and Portland cements. He will also review the present state of the cement industry in the United States, giving the results of tests made with cements from different parts of the country. Mr. B. B. Lathbury, chemist, will write on "The Economic Value of Concrete Tests," and "Strength of Cement after Long Storage in Original Packages." Among the other contributors to this department will be Prof. Cecil B. Smith, McGill University, Montreal.

In the department devoted to Recent Brick and Terra-Cotta Work in American Cities, we shall illustrate many of the latest and best examples of architecture in these materials.

SERIALS.

For want of space we were unable to conclude during the past year, Mr. Dillon's translation of Choisy's "L'Art de Bater Chez les Romains." This work is now so far advanced we may safely promise its completion during 1897, after which the reprint of Street's "Brick and Marble in the Middle Ages" will be resumed. This latter work will be even more elaborately illustrated than the original.

EDITORIALS AND CURRENT TOPICS OF INTEREST.

Our editorial staff consists of the ablest of writers on the various subjects treated, and by them current topics of interest will be discussed.

The Brickbuilder is published monthly at Boston,
By Rogers and Manson,
Publication Office, 85 Water Street.

Subscription Price, $2.50 per Year.

B.P.L. Bindery,
APR 23 1897